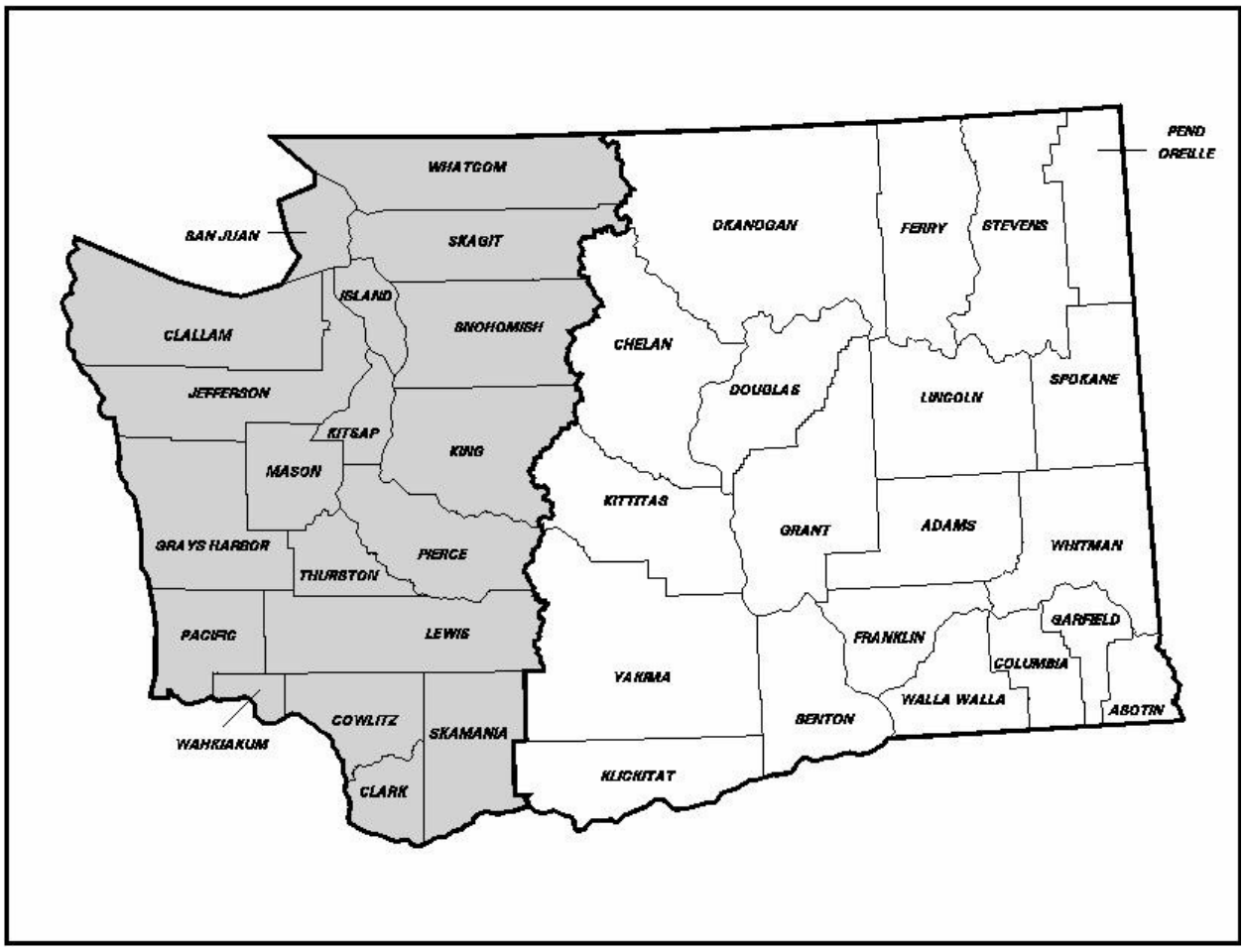
FIELD INSTRUCTIONS

FOR THE

INVENTORY OF WESTERN WASHINGTON

2000



Forest Inventory and Analysis Program

Pacific Northwest Research Station

USDA Forest Service

FIELD INSTRUCTIONS

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2000

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I. INTRODUCTION

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I. INTRODUCTION

This manual documents the field procedures by the Forest Inventory and Analysis Program (FIA) in the 2000 inventory of western Washington.

FIA, a program within the Pacific Northwest Research Station (PNW), USDA Forest Service, is one of five Forest Inventory and Analysis work units across the United States. PNW-FIA is responsible for inventorying the forest resources of Alaska, California, Hawaii, Oregon, and Washington.

A. Purposes of this manual

This manual serves two purposes, to:

- instruct field personnel in how to locate and measure field plots in the 2000 inventory of western Washington.
- document the field procedures, methods, and codes used in the inventory.

B. Organization of this manual

This manual is structured primarily for use by field personnel. Each chapter corresponds either to a separate function that must be performed in locating and measuring a field plot, or to a particular aspect of data recording that must be completed.

The procedures in this manual are ordered to coincide as much as possible with the order in which field data items are collected and entered into the field data recorder. Some procedures and codes are repeated in multiple chapters of the manual to minimize the need to refer to additional chapters while collecting data in the standard order.

This manual incorporates some of the field data collection procedures of the Forest Inventory and Analysis National Core Field Guide. Instructions in shaded text, and data items in all capital letters describe data items or field procedures that are a part of that guide. Several of those items are still under development, or have unresolved issues at the time of this printing. Temporary regional adjustments are noted in *italic font* within the shaded text. Portions of this manual which are not shaded are regional variables or procedures which supplement the national core data. The complete set of National Core Field Guide procedures will be implemented, and the national-design 4-subplot plot will be installed, at the time of the next western Washington inventory, currently scheduled to begin in 2001.

Information that is infrequently used or that is included only for documentation is in the appendices at the end of this manual. A glossary and an index are provided for quick reference.

C. The inventory of western Washington

Background

PNW-FIA inventories all of western Washington except for large bodies of water (Census water) and land administered by National Forests. Inventories conducted by the National Forest System are combined with the PNW-FIA inventory to provide information across all ownerships.

The 2000 inventory of western Washington represents the fourth visit to a permanent grid of field plots established and periodically reinventoried by PNW-FIA. These plots were previously visited in 1963-1967, 1978-1979 and 1988-1990. Throughout this manual the abbreviations "Oc1", "Oc2", and "Oc3" refer to these previous western Washington inventories: occasions 1, 2, and 3 respectively. The current 2000 inventory is labeled "Oc4" (occasion 4) in this manual.

Previous inventories were conducted in the 1930's and in the 1950's. In the 1930 inventory, existing information on forest types, timber cruises, logging records and other data was collected from private individuals and public agencies. These data were field checked and adjusted to the then existing inventory specifications. All lands were classified as forest or nonforest. Forest land was classified as either commercial or noncommercial. Commercial forest land was further classified by type, size and

stocking class and was mapped on base maps of each forested township. A superimposed ownership map was dot counted to obtain area statistics by forest type and owner class for each county.

In the 1950's inventory, aerial photos were used to create forest type maps for each county. Forest type, size, and stocking classes were similar to the ones used in the previous inventories, but the use of photographs allowed a much higher degree of detail and accuracy. In addition, net sawtimber, growing stock, cull, and salvable dead volumes were calculated by applying per-acre volumes to the acreage of each forest type class. Per acre estimates were obtained through a system of sampling stands in each different classification. Field samples were measured using a series of three one-fifth-acre circular plots spaced at six-chain intervals. This design was subsequently changed to the sampling scheme currently in use.

Inventory design
The western Washington inventory design is based on a double sample for stratification as described by Cochran (1977, p. 327-335), but differing from Cochran's description in that both primary and second phases are permanent, systematic grids of photo and field plots and therefore, not strictly allocated proportionally by stratum. The primary plots are on a 0.85 mile (1.37 kilometer) grid that was established on base maps and transferred to aerial photos. The primary grid is subsampled by the secondary field grid. The field plot grid is laid out on 3.4 mile (5.47 k) intervals, providing an average of one secondary field grid location for every 16 primary photo plots. The primary phase--the photo grid--is used to stratify inventoried area by land class and degree of urbanization, and, where forest land, by forest condition. The stratification reduces overall variance, resulting in more precise estimates of forest area and volume statistics. Data collected on the field plots are used to adjust area estimates developed from classification of the primary grid and to obtain comprehensive information about forest conditions that is of known precision.

Products
PNW-FIA provides information needed by resource planners, policy analysts, and others involved in forest resource decision-making. Data collected in PNW-FIA inventories is summarized, interpreted, analyzed, and published in statistical and analytical reports of national, state, and subregional scope. PNW-FIA publishes information on area by forest land and owner classes and by degree of urbanization; land use change; timber volume, growth, mortality, and removals; potential forest productivity; opportunities for silvicultural treatment; and kind and area of wildlife habitats. PNW-FIA also provides data to answer questions about forest resources.

Research topics
The data collected in these inventories represent a wealth of information for both applied and basic questions concerning forest ecosystems. Topics include: the distribution of plant species and their relationship to environment, the incidence of insects and disease in relation to forest type and condition, changes in forest structure in productivity due to disturbance, and improved prediction of forest growth and development on different sites and in response to management.

D. Additional sources of documentation

More information about the 2000-2001 inventory design and procedures are available in the following documents which are on file at the office of the program in Portland, Oregon:

Forest Survey field instructions for western Washington -- 1978-1979.

Field instructions for the inventory of western Washington -- 1988-1989.

Field instructions for the intensification inventory of western Washington -- 1990.

Western Washington photointerpretation (PI) manual -- 2000.

Complete documentation of the 2000 inventory of western Washington (when finished in 2001).

Forest Inventory and Analysis National Core Field Guide: Phase 2. Version 1.4 -- February 2000.

II. TRAVEL PLANNING AND LOCATING THE PLOT

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II. TRAVEL PLANNING AND LOCATING THE PLOT

A. Landowner contact

Permission

Written or verbal landowner permission must be obtained before a plot is visited. This responsibility lies with the field coordinator who may delegate contacting the landowner to the field crew.

In preparing for the field season, PNW-FIA sent each non-industrial private landowner with a plot on their land a letter that asked permission to visit and measure the plot. If the owner responded, a postcard with their response is in the plot jacket. Owners of large land areas--primarily private timber companies and public agencies--are contacted individually; access information for these plots will be provided by the crew coordinator or will be included in the plot jacket.

Recording conversations with landowners

Include a record of each conversation with a plot landowner on the Ownership Contact form. While not a part of the official plot record, this information will document that permission was obtained, assist in accessing the area for check-plots, and possibly aid the field crew during a future inventory.

Ask landowners if they can confirm the dates of any disturbance (usually harvesting) on the plot since Oc3; record this date on the Plot Attribute Record. Record any special circumstances about plot accessibility--such as locked gates or washed-out roads on the Plot Record.

Data requests

Copies of the most recent state reports are found in all field vehicles and may be given to requesters. Plot specific data is released only to the legal owner of the plot area. Requests for photocopies of the field data sheets and plot card, summarized plot data, and for copies of future publications based on information collected in this inventory should be noted in Item 18 of the Plot Attribute section of the field data. Current plot data will generally be sent to the owner after the field season is completed and plots are returned to the office. If the landowner desires, the crew may provide photocopies of plot data immediately after collection.

Any additional data requests should be referred to the client request person in the Portland office:

Otha Terry
Portland Forestry Sciences Lab
P.O. Box 3890
Portland, OR 97208

phone: (503) 808-2044
email: oterry@fs.fed.us

B. Before leaving base camp

1. Make sure the landowner has been contacted (see above).
2. Plan the route to the plot. Always bring two or more extra plots.
3. Leave word of plot locations and expected destinations with the crew coordinator.
4. Make sure your vehicle has all of the necessary field gear and a plot map.
5. Be in agreement with your crew partner(s) on a work procedure.
6. Inspect vehicle for fuel, oil, lights, safety features, and plot supplies (stakes, tags, pins, and nails) prior to departure.

C. Checklist of items needed on plot

Data recording items

Previous plot records and photos
Plot jacket (Oc1, Oc2, Oc3, and Oc4 plot records with subplot diagrams, and field photos)
Hand-held data recorder downloaded with plot records; extra AA batteries
GPS unit with fully-charged batteries
Mechanical pencils, red photo pen, black pen, eraser
Note pad(s) made of "write-in-the-rain" paper
Blank forms for plot, subplot, condition class attributes; tree tally; CWD; veg profile; and subplot diagram
Calculator(s)

Tatum and tatum aids
Field procedures manual
Plant ID guide(s), plant association guides, plant disease guide

Photo interpretation items
Plot (road) map
Stereoscope(s) (2x and/or 4x) with case and sharp straight pins
Photo scale (Timber Survey Aid #16)
6 inch ruler calibrated in 1/20th inches
Hand lens

Plot measuring items
Prism(s) 7 M BAF
Compass(es)
Clinometer(s)
Diameter tape(s)-20 foot
Increment borer(s) with sheath
100 foot tape(s) with carabiner(s)
Hand axe(s) with sheath
Laser height/rangefinder
Plant press for plant specimens and paper bags for root disease samples

Plot referencing items
Cedar stakes
Steel plot pins
Aluminum nails
Tree number tags
Square aluminum tags
Round aluminum tags
Flagging tape

First aid items
First aid kits
Bee sting and/or snake bite kits

Personal and safety gear
Canteens with water
Lunches
Utility pouch
Vest and hardhat
Rain gear
Gloves
Flashlight and batteries
Extra clothing
Extra food

D. Safety

Personnel working in the field are subject to many safety hazards. Each person must always be conscious of these hazards to avoid accidents:

1. **Don't take chances!**
2. **Eliminate horseplay and carelessness!**
3. **Think safety!**
4. **No task is more important than personal safety!**
5. **Always make sure that someone else knows where to plan to work each day!**

Safety in the woods

Wear protective clothing: Long-sleeved shirts, long pants, and gloves may protect you from contact with brush and rocks, poison oak, and stinging insects. Trouser legs should be loose enough to avoid binding or cramping, and should not have cuffs. Wear a hardhat at all times in the woods. During hunting seasons, wear bright red or orange clothing.

Wear good quality boots that provide good support and traction. For example: 8-inch high leather work boots with lug-soles (Vibram-type soles).

Walk, don't run in the woods. Take your time and plan your route. Avoid plunging through the brush. The best route of travel may not be the shortest. Routes across brushy, irregular terrain with rocks and down logs can be hazardous.

Be watchful of twigs and branches, which may cause eye injury. Be especially alert when stepping up to trees which retain their small dead twigs. Keep a sufficient distance behind the person ahead of you to avoid being slapped by branches.

Lift knees high to clear obstacles in heavy undergrowth or slash. Slow down and watch your step.

When contouring a steep slope, do not lean into the hill. This tends to loosen footing. Erect posture or slightly leaning out gives more secure footing.

Know how to fall to avoid hard impacts. Keep flexible with knees slightly bent. If you feel yourself slipping, pick a landing spot. Do not stick your arms out to break a fall. Roll with the fall. Try to take the impact on the side of your body rather than your back.

Don't take chances by walking across ravines on small logs.

Bee aware. Keep an eye out for yellow jacket and hornet activity. Yellow jackets nest in the ground, often in well-decayed logs or in thick moss on trees or in snag cavities. Yellow jackets are particularly active (nasty) during late summer and early fall when forest conditions are very dry. Hornets nest above ground in "paper" nests that are suspended from branches; woe befalls those who unwittingly bump their head against a nest, or shake the sapling from which a nest is suspended. If allergic to insect stings, carry medication to counteract the effects of stings.

Be alert to rattling or buzzing noises. Look before putting hands or feet on or under rocks and logs. Be alert when walking in snake-infested areas.

Avoid poison oak, if possible. Place oil on exposed skin before going to field. After contact with poison oak, remove clothes carefully, wash exposed areas with cool, soapy water, and wash clothes before wearing them again.

Keep someone posted as to where you plan to work each day, particularly on long hikes into the forest, so that if you do not return in a reasonable time, someone can find you.

Keep hatchets in their sheath except when actually using them, and snap the sheath shut.

First Aid. Keep your individual first-aid kit completely supplied, and know how to use it. Treat all wounds promptly. Each vehicle is supplied with a large first-aid kit – keep it stocked.

Carry matches and possibly a small flashlight. On very long hikes, take extra food, clothing, and matches in case you are caught out in the woods at night. Never build fires in forest duff or leave a campfire until it is dead out.

Check for ticks. The beasties bite and can carry Lyme disease.

Carry plenty of water. Don't expect your partner to carry water for you.

Beware of lightning. Watch for approaching storms. Avoid prominent high exposed ground and tall/lone trees. Abandon field gear, especially that made of metal. Seek shelter in the vehicle if possible, otherwise in thick timber, large caves or in valley bottoms. Crouch on the balls of your feet with your head covered. Separate 100 feet from other crew members.

Safety on the road
It all pays the same, so drive with care, with courtesy, regardless of others' actions, and with common sense. Follow these tips:

Seat belt use is required in all government-owned or leased vehicles and is required by law in the States of Washington, Oregon and California. Do not ride in the back of pickups.

DRIVE DEFENSIVELY! Expect the other person, whether a vehicle operator or a pedestrian, to do the worst thing and be prepared. Observe all speed regulations and traffic signs.

Do not drive when sleepy, taking medication, or when other personal conditions make it unsafe to drive a vehicle. Get someone else to drive or, if alone, stop driving and nap (out of the public view).

Always drive with your headlights on. This practice increases the visibility of your vehicle. It is particularly important when driving in fog, on dusty roads, traveling in and out of shadows, and any other low light/visibility situations. Turn lights off when you park the vehicle.

Do not operate a vehicle in an unsafe condition. Check your vehicle frequently to keep it in good mechanical condition. Lights, horn, steering, and brakes should be kept in proper adjustment at all times. Make necessary repairs as soon as unsafe condition develops. Report any unsafe conditions to your supervisor.

Keep the vehicle clean. Windows, mirrors, and lights should be kept clean and free of obstructions to increase visibility. Keep the cab and driver area clean so material is not rolling under pedals or distracting the driver.

Shift to a lower gear at the beginning of a grade, if the grade is a long, steep descent.

Adjust vehicle speed to the driving conditions. Wet, icy, or snowy roads and decreased visibility require decreased speed. Be aware of speed when changing from one type of road to another, i.e., Freeway to secondary highway to gravel and adjust speed accordingly.

Don't tailgate. Allow at least three seconds of travel distance between yourself and the vehicle ahead. Under slippery road conditions and poor visibility, allow more distance.

Be aware of your vehicle's idiosyncrasies and adjust your driving accordingly.

Be alert for heavily loaded trucks moving at high speeds when driving on privately-owned log-haul roads. Observe all traffic control signs, particularly signs requiring you to drive on the left side of the road.

Back up safely. Walk around your vehicle to check for hazards before backing and use a spotter to guide you.

Do not drive and navigate at the same time. If the driver needs to look at maps and photos, stop at a safe place, then look at them.

Watch for animals on the road. Most hoofed animals travel in groups, so where there is one, assume there are many, with all just itching to jump out in front of your vehicle. Stop and let the animal move off the road, look for others to follow, then proceed on. If you can not stop in time to avoid hitting an animal, it is generally better to hit it, than to go off the road or hit another vehicle.

Park the vehicle so that it is not a hazard to other drivers. Do not park where dry grass or other potential fuels can come in contact with your vehicle's hot exhaust system.

Keep as far right as is safely possible on blind curves on logging roads. If the curve is blind and less than two lanes wide, slow way down and be ready to take evasive action.

Yield to uphill vehicles on roads wide enough only for one vehicle.

What to do if injured

Treat the injury promptly. If immediate medical attention is required, go directly to a hospital emergency room. Try to make contact with your supervisor or the office to get instructions and assistance. Make sure the doctor fills out his/her part on the CA-1 form.

Inform your supervisor of all injuries and ask which, if any, forms need to be filled out. Supervisors must inform the office at the earliest opportunity.

Fill out Federal accident forms completely with signatures. ALWAYS make a copy for your personal records. Give the completed forms to your supervisor. Have the supervisor check your entries for mistakes, fill out their section, and forward the completed forms to the appropriate person.

Gather Information. If you are in a multi-vehicle accident, provide the other parties with enough written information so that they can easily get in touch with you, your crew supervisor, and the office. In turn, you must get the following information from all involved parties and witnesses -- names, addresses, phone numbers, vehicle license numbers, driver's license numbers, insurance company names and policy numbers, and police report numbers. If possible, do not admit responsibility without first contacting your supervisor.

E. Plot location aids

Each field crew should have a road map with the location of the plots marked and a plot packet for each plot you may visit. The plot packet for each field plot will generally contain Oc1, Oc2, Oc3, and Oc4 photos, Oc1, Oc2, and Oc3 plot records with plot diagrams, Oc4 computer-printed Plot, Subplot, and Condition Class Attribute records, computer-printed Oc3 tree tally records, and a plot review sheet.

Use the road map, plot cards and aerial photos from the previous inventories to locate the plot. The county, plot number, and legal description (township, range, section, and forty) are printed on the Plot Attribute record. Plot locations are marked and numbered on the road map. Use the road map to reach the general vicinity of the plot by motor vehicle. Once you are within the area covered by the photos, you may use the photos to find the exact plot location on the ground.

Revisited plots

The plot location is pinpricked and circled on the Oc3 photos. The plot number is marked in the upper right-hand corner on the front of the old photo, and on the backside near the circled pinprick. The plot number is also marked on the upper right-hand corner of the new Oc4 (un-pinpricked) photos. For plots visited previously, the Oc2 and 3 plot cards have a section "Route to RP" which may provide information useful for locating the plot.

Colocated plots

A subsample of field plots have been visited by Forest Health Monitoring (P3) crews. These plots were established using the 4-subplot design and will have detailed current information on finding the plot, and will usually have GPS coordinates downloaded/printed in the Plot Attribute record.

F. Locating the plot on the ground

Locating previously measured plots

When revisiting established plots, use both new and old photos to proceed to the plot area. It is often easier to use the new Oc4 photos to arrive at the general location and the photos from previous inventories to find the exact location of the plot. It is generally easier to locate an established plot by heading directly to the plot rather than to the Reference Point (RP). The reason: the RP is a single tree with a couple of tags, whereas within the plot area are several to many trees with reference tags, tree numbers and/or diameter nails; in short, more "signs" to detect. In searching out the plot, you may find a tagged/numbered tree on one of the subplots--use the plot card from the most recent visit (Oc2 or 3) to determine which subplot you are on.

The RP tree has square aluminum tags on two sides of the tree at 6 feet above ground line, and one square aluminum tag below stump height facing towards the field grid location. If needed, travel notes, remarks, and a description of the RP trees can be found on the front of the Oc2 or 3 plot cards and on the back of the Oc2 or 3 photos. Before beginning the traverse from the RP to the plot, check the photos to see if the azimuth and distance seem reasonable. Some photos will be marked with a point-of-departure (POD). They are usually near a road and indicate how the crew arrived at the plot area.

If you have difficulty finding an established plot, follow these steps:

1. Return to the last known point on your route into the plot. Plan a route to the pinpricked field grid location; divide the route into stages with an identifiable physical feature at the end of each stage that you can identify on the photos and can find and confirm on the ground. Proceed stage by stage, never embarking on the next stage until you know without a doubt that you have identified the endpoint of the previous stage. The endpoint on the last stage is the pinpricked location with its referenced trees.

2. If you tracked your way into the plot area but you don't find any signs of the plot, look for stream confluences, ridges, openings, groups of large trees, old skid roads, large snags etc. on the ground, to reconfirm without a doubt that you are at the pinpricked location.

3. Still no plot? Try to locate the area that previous crews might have been when they thought they were at the pinpricked location. Check the Oc3 plot card for information such as:
   a) Remarks that provide insight on plot location. For example: "Point center moved back 20 feet on same azimuth to agree with photo pinprick."
   b) Stand type and size of trees. If the plot is in large sawtimber stand of fir, the crew would know they were off if they were in a poletimber stand of pine.
   c) The size and species of the RP and subplot 1 reference trees.
   d) Direction of travel from the RP--it could be 180 degrees off.
   e) Any other indicator such as slope and aspect.

G. Plots with active logging

If the plot area is being logged (timber is being felled, bucked, or yarded) or is unsafe to visit because of active logging, DO NOT ESTABLISH THE PLOT. Note on the plot jacket the status of the logging operation and return the plot to the supervisor. The supervisor will hold the plot until later in the season, when the status of the logging operation will be checked again to see if the plot can be completed.

H. Denied access-plots

If access is denied to the field grid location or a portion of a plot, see the instructions on pages 16, 52 and 67.

I. Plot location MQO

Plot location:
MQO: Remeasured plot: relocated
New plot: located +/- 30.0 ft.

Aerial photograph:
MQO: Oc3 and Oc4 pinpricks in correct spot: no errors
Oc4 plot center and RP labeled correctly: no errors

III. PLOT LAYOUT AND REFERENCING

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III. PLOT LAYOUT AND REFERENCING

A. Background: plot layout at previous inventories
In the late 1950s, PNW-FIA generated a grid of field locations across all lands in western Washington. This was done on USGS map or other available map coverage. To generate the grid on these maps, a point was selected randomly, and from this point grid lines were mapped out on cardinal directions every 3.4 miles. The intersections of these east-west and north-south lines on the maps became the basis for locating field plots on the ground in all PNW-FIA inventories since the late 1950s. In some cases, the grid was drawn county by county, and errors caused gaps or concentrations in the grid where the lines did not match up along county boundaries.

Occasion 1
All western Washington counties were assigned to one of three administrative units, the Southwest unit, the Olympic Peninsula unit, or the Puget Sound unit. The counties and their units are listed on page 23. Plots were established in 1963 (Southwest), 1965 (Olympic Peninsula) and 1966 (Puget Sound) using a 1-acre, 10-subplot plot.

Occasion 2
At Oc2 the Southwest unit and half of the Olympic Peninsula were measured in 1978, and the Puget Sound unit and remaining half of the Olympic Peninsula unit 1979. Four of the previous 10 subplots were remeasured and a new 2.5 hectare, 5-subplot plot was installed.

Occasion 3
All three units were remeasured during 1988 and 1989. About 2/3s of the plots were fully remeasured, the other 1/3 (mainly in older, undisturbed stands) were "walk-throughs". On walk-through plots, subplots 1 and 2 were fully remeasured and a more limited set of measurements was made on the other subplots.

Grid Intensification (Oc3)
In 1990, the state of Washington funded the installation of additional field plots in western Washington. These new plots were located in between the regular grid points, doubling the number of plots. Field procedures used were nearly identical to those used on the regular grid plots. These plots will not be remeasured during the Oc4 inventory.

Forest Health Monitoring Program (Phase 3)
In 1997, forest health monitoring (FHM) plots were installed at the grid locations on 100 of the plots in Western Washington. About 30 of these plots will be revisited during each subsequent field season. On FHM plots, tree, vegetation, lichens, ozone, and soils data are collected. FHM plots use the 4-subplot, 24.0 and 58.9 ft. fixed-radius design which will be used by PNW-FIA crews when the annual inventory system is implemented (currently anticipated in 2001). After the full integration of FHM and FIA the two types of plots will be referred to as Phase 3 and Phase 2 plots respectively. Copies of FHM tree tally cards will be in the plot packet.

B. Occasion 2 and 3 subplot location
Usually, the 5-subplot plots installed at Occasions 2 and 3 were laid out in the standard pattern diagrammed on page 16 (the older 10-point plot is diagrammed on page 181). However, subplots were installed at positions off of the standard pattern in order to keep all 5 subplots entirely within the same forest land class and stand condition (broad forest type and stand size); i.e., subplots were never split between forest and nonforest land or between different stand condition classes.

The location of subplots that were not on the standard pattern was determined one of two ways:

1) A substitute subplot location (a "**substituted subplot**") was adopted if the center of the standard subplot location was in different forest land class or forest condition than was present at the field grid location.

2) If the subplot center was in the same forest land class and forest condition class as the field grid location but was within 55.8 ft. of a different land class or forest condition class, the standard subplot center was moved (a "**moved subplot"**) until 55.8 ft. inside the same forest land class and forest condition present at the field grid location.

C. Census water, Denied access, Hazardous, and Not in the sample areas

At the current inventory:

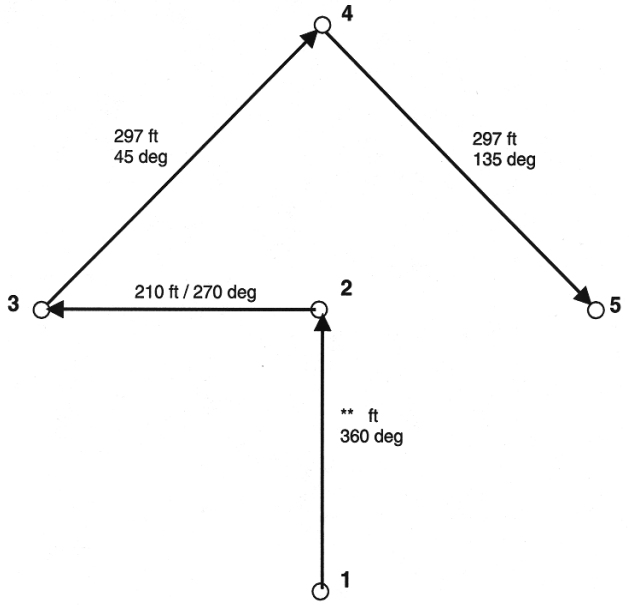
Plot Center (subplot 1)
1. If plot center (the center of subplot 1) is Census water, Denied access, Hazardous, or Not in the sample, the entire plot is considered Census water, Denied access, Hazardous, or Not in the sample respectively.
2. No replacement plot is selected.

Subplots 2 though 5
1. If a subplot center **can** be physically occupied, then any Census water, Denied access, Hazardous, or Not in the sample areas are mapped as separate condition classes. Measurements are taken only in any accessible forest land condition classes.
2. If a subplot center **can not** be physically occupied (i.e. Census water, Denied access, or Hazardous) the subplot will not be installed or referenced. The entire subplot is classified as the subplot center condition, even though a portion of it may be in another condition class.

See mapping Condition Status on page 47 for further instructions.

D. Plot layout at the current inventory (Oc4)
In the current (Oc4) inventory a portion of the 5-subplot plot installed at the previous inventory (Oc3) is reassessed. The standard layout used at Oc3 is shown below. However, as described in section A of this chapter, at Oc2 and Oc3, subplots were "substituted" or "moved" in order to keep the entire subplot within condition class 1.

Standard 5-subplot plot diagram



** The distance between subplot 1 and subplot 2 varies by inventory unit. See page 23 to determine which inventory unit a plot is in. Distance between subplot 1 and 2:
OLYMPIC Unit: 210 ft. PUGET Unit: 140 ft. SOUTHWEST Unit: 180 ft.

E. Recognition of condition classes
Plot area recognized as within inventoried area is divided into condition classes. The area within each subplot's 55.8-foot fixed-radius plot is mapped by condition class. Condition classes are first defined by differences in condition status. Some of these condition classes may be further subdivided by other attributes. The condition class in which the field grid location lies (the center of subplot 1) is always

condition class 1. While most subplots encompass only one condition class, some will have two or more classes within their 55.8-foot radius.

Condition classes are determined in three steps:
(1) Plot area is divided into condition classes based on differences in condition status.
(2) Accessible forest land condition classes are further divided by differences in 6 mapping variables.
(3) Nonforest land condition classes are further divided, in some cases, by differences in nonforest land use.

See the Condition Class Attributes chapter on page 47 for complete instructions.

F. Subplot numbering at Oc4 on plots measured at Oc3

Revisit up to three ## subplots
Evaluating Oc3 subplot 1 first and working consecutively through Oc3 subplot 5, revisit the three lowest number subplots that qualify as ## subplots.

A subplot is a ## subplot if **ALL** of the following are true:
a) The subplot was established at Oc3, **AND**
b) The subplot was part of a plot measured at Oc3 which had an Oc3 GLC of 20, and is accessible forest land at Oc4, **AND**
c) The subplot center is in condition class 1.

subplots may, or may not be, located on the standard 5-subplot plot layout.

All condition classes present on the subplot (within the 55.8 ft. fixed-radius plot) are mapped on the subplot diagram. If condition class 1 is still accessible forest land, trees and snags tallied at Oc3 are remeasured, and new live trees (tree histories 2, 4 and 6) and snags (tree history 7) are tallied in condition class 1, and reconstructed (see definition below) if ≥1.0 in. d.b.h. and a tree history of 2 or 6. Understory vegetation, down woody debris data are collected. These data are not remeasured or collected in any other mapped condition classes on a ## subplot.

"Reconstruct" means that trees sampled live and ≥1.0 in. d.b.h. are backdated to estimate Oc3 crown ratio and crown class, and d.b.h. is also backdated if currently ≥5.0 in. Additionally, when required, trees culturally-killed, dead of natural causes, or harvested that were live at Oc3 are sampled and backdated to estimate Oc3 d.b.h., crown ratio and class, and several other Oc3 attributes; these trees must be ≥1.0 in. d.b.h. to be tallied as a culturally killed tree (tree history 3) or a tree dead of natural causes (tree history 5) and must be ≥5.0 in. d.b.h. to be tallied as a harvested tree (tree history 8).

G. Referencing the plot

1. Referencing a plot visited previously
Find the location of the plot pinpricked on field photos at last visit. This previously pinpricked location is the field grid location for the plot. It was monumented at last visit with a cedar stake in the ground. The cedar stake was referenced at last visit by a RP and by two nearby reference trees. Both the RP and reference trees were marked distinctively with square and round tags using the same protocol for described for tagging the Oc4 RP and Oc4 reference trees starting on page 18. If a previously established plot can not found, refer to "Referencing a lost plot" in this section.

The species of the old RP, it's d.b.h. to the nearest centimeter, the azimuth from RP to cedar stake, and the slope distance in meters from RP to the cedar stake were recorded on the plot card and aerial photo used at the last visit. Similar data were recorded for the nearby trees referencing the cedar stake except that azimuth was recorded from the cedar stake to the tree, and distance was recorded to the nearest centimeter. Data downloaded to the Husky computer at Oc4 will be converted to English units. Apply these data in relocating the (pinpricked) location of the old cedar stake.

On some plots, Oc3 RP referenced a subplot center other than the pinpricked location; on these plots, the cedar stake was still installed at the pinpricked location. Also, on plots where subplot 1 was moved at Oc3 to stay entirely in one condition class, the pinpricked field grid location, monumented by the cedar stake, and Oc3 subplot 1 center are not at the same place on the ground.

Once the location of the field grid location (old cedar stake) is known, do the following steps:

a) Install a new cedar stake at the field grid location. Check to see that "An exception" on page 18 does not apply.
b) Reference the stake to two nearby trees; see "Referencing the cedar stake" on page 19.
c) Reference the new stake to an RP; see "The reference point (RP)" on page 18.
d) Determine and pinprick the location of the field grid location on the Oc4 photos using photointerpretation. Using a photo pen, circle the pinprick on the back of the photo and write "PC" (plot center) and the plot number near the circle.
e) Determine and pinprick the ground location of the RP on the Oc4 photos using photointerpretation. Circle the pinprick in pencil on the back of the photo and write "RP" near the circle.

Referencing a lost plot

A plot which was established previously in the field but can not be found is a lost plot. No field measurements are taken on lost plots during the western Washington 2000 inventory. Return the plot to the field supervisor who will also attempt to locate the plot.

2. An exception

The cedar stake is not placed at the field grid location if the 55.8-foot fixed-radius plot at subplot 1 on the standard layout is entirely nonforest land and either of the following situations occur:

a) the center of subplot 1 is too hazardous to visit (examples: subplot center 1 is in the middle of a pond, or the middle of a freeway, or on the side of a cliff) **OR**
b) placing the cedar stake at the center of subplot 1 is very apt to irritate a landowner (example: subplot center 1 is in the middle of someone's front lawn).

If the exception applies, reference the center of the lowest-numbered subplot on the standard layout that has a forest land condition class present within it's 55.8-foot fixed-radius plot.

Specifically, do the following steps:

a) Place a cedar stake at the center of this subplot,
b) Reference the new stake to two nearby trees; see "Referencing the cedar stake" on page 19.
c) Reference the new stake to an RP; see "The reference point (RP)" on this page.
d) If a revisited plot, determine and pinprick the location of the field grid location on the Oc4 photos using photointerpretation. All plots: circle the pinprick in pencil on the back of the photo and write "PC" (plot center) and the plot number near the circle.
e) Determine and pinprick the ground location of the RP on the Oc4 photos using photointerpretation. Circle the pinprick in pencil on the back of the photo and write "RP to subplot (insert number)" near the circle (Example: "RP to subplot 3").

Keep in mind that the field grid location in this case, is not at the location of the cedar stake. The field grid location is always the center of subplot 1 on the standard layout regardless of whether it is referenced.

3. The reference point (RP)

The RP references the cedar stake. It is an object (usually a tree) that is prominent, apt to be present at next visit and easily located on the ground.

Selecting an RP: The RP should be distinctive on both the ground and on the Oc4 photos. You may reuse the Oc3 RP tree if it is suitable. If the old RP tree is dead, missing, or difficult to identify on the ground or on the plot photo, select a new RP. If possible, it should be a tree which is not likely to die or be cut before the next inventory. You may select a snag or other object for an RP (i.e., a distinctive fence post, building corner, telephone pole, etc.). If you use such a RP, describe it on the plot photo and in "Location Description" on the Plot Record.

Tag the RP: Mark the RP tree with new or reused tags. Nail aluminum square tags on two or more sides of the RP tree, 6 feet above ground line, facing directions you expect future crews to approach the RP. Also nail an aluminum square tag on the RP tree below stump height, on the side of the tree facing the cedar stake. When attaching a tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.

Pinprick the RP location: Pinprick the ground location of the RP on the Oc4 photos UNLESS the RP pinprick would obscure another pinprick. Circle the RP pinprick on the back of the photo and write "RP" and the plot number near the circle (but do not obscure any pinpricks).

Record RP data: Record the species of the RP, it's d.b.h. to the nearest inch, azimuth from RP to cedar stake, and slope distance measured to the nearest foot from RP to the cedar stake on the back of the aerial photo, under "Plot Reference" on the Plot Record, and in the Plot Attributes section of the plot data.

In "Location Description" on the Plot Record, record any information that would aid the next crew in relocating the plot. Describe prominent features present in the plot area that are unlikely to change in the next ten years; examples include details such as slope, aspect, topographic position, recognizable physiographic features (i.e. streams, rock outcrops, benches), man-made features, and unusual or large trees. If any new roads have been built in the plot area since the date of the Oc4 field photos, sketch them on the photos if it will help the next crew to find the plot.

Example: "The RP is a large Douglas-fir (over 120 feet tall) in a draw that descends northeast from mainline logging road 1000. Subplot N1 is down slope from the RP and is just down slope and next to a large rock outcrop."

4. Referencing the cedar stake

To reference the cedar stake with nearby trees, **do the following steps:**

a) Select two trees near the cedar stake that form, as closely as possible, a right angle with the stake. If the Oc3 reference trees meet this criterion, reuse them. On a revisited plot, if you select a new reference tree, remove the square tags (if present) from the reference tree it is replacing to avoid confusing the Oc5 crew. Trees within 6 feet of the stake are preferable. If live trees are not available, use stumps or sound snags.
b) Nail a square aluminum tag below stump height (<1 foot above the ground) on each reference tree on the side facing the stake. If the trees are also numbered tally trees, attach the tree number tags with the same nails. When attaching a tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.
c) In two locations on each reference tree, nail a round aluminum tag 6 feet high facing likely approaches to the subplot.
d) Record data about the reference trees; refer to "Recording reference tree data" on page 19.

H. Referencing the other subplots on the standard layout

One subplot on the standard layout, usually subplot 1, is referenced adequately by the cedar stake and it's nearby reference trees and RP. Other ## subplots that have forest land present somewhere on their 55.8-foot fixed-radius subplot also require referencing. Do the following steps:

1. Install a metal pin at subplot center.

Mark subplot center with a metal pin and round, or reuse the previous pin and round. In either case tie a piece of flagging to the pin.

2. Mark the subplot center area with flagging.

Hang a piece of flagging on a tree or branch within the vicinity of the subplot center stake.

I. Recording reference tree data (all subplots on the standard layout)

Azimuth (subplot center to tree), slope distance to the head of the nail affixing the tree number tag or basal aluminum tag, species and diameter are recorded for each reference tree, snag, or stump.

1. If a tally tree

If a reference tree or snag is a trackable tally tree, enter a "*" after it's tree history by entering a "V" on the Husky data recorder; the Husky will then insert an asterisk after the tree history to indicate the tally tree is a reference tree.

If the reference is a standing dead tree with a tree history 3 or 5, or is the stump of a tree with a tree history 8 or is a snag with a tree history 7 that has a "reason for disappearance" code of 2 through 6, enter a new reference record for the tree or stump; assign the record a tree history of 9, and record azimuth, distance, species, and diameter (use the Oc3 d.b.h. if reasonable).

NOTE: Reference tree distance is always slope distance from the subplot center to the head of the nail affixing the tree number tag or basal aluminum tag.

2. If not a tally tree

If a reference is not a trackable tally live tree, snag or stump, enter a new record; assign tree history of 9, and record azimuth, distance, species, and Oc4 d.b.h. If d.b.h. is 3.0 in. or larger, measure the diameter as accurately as you would for a live tally tree. This is important because a reference tree may grow big enough to be a live tally trees at the next occasion.

J. Plot layout and referencing MQO

RP selection:
MQO: No error in selection criteria

RP data items:
MQO: see Reference point (RP) data items on page 30

Subplot location:
MQO: Remeasured subplot: +/- 0.5 ft. of previous location
New subplot: +/- 5.0 ft.

Subplot reference (tree) selection:
MQO: No error in selection criteria

IV. PLOT ATTRIBUTES

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IV. PLOT ATTRIBUTES

Plot attributes record plot location and information about the field crew visit and landowner contact. This information aids future crews in plot relocation, sets up date and inventory cycle information in the data recorder, and makes it possible to analyze the relationship of plot data to other mapped data (i.e. rivers).

Item 1--STATE

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.

Do not change the downloaded/printed code.

Code	State
53	Washington

Item 2--COUNTY

Record the unique FIPS code identifying the county where the plot center is located.

Do not change the downloaded/printed code.

Code	County	Declination degrees-East	Unit
009	Clallam	19 ½	OLY
011	Clark	18	SW
015	Cowlitz	18 ½	SW
027	Grays Harbor	19	OLY
029	Island	19	PS
031	Jefferson	19	OLY
033	King	18 ½	PS
035	Kitsap	19	PS
041	Lewis	18 ½	SW
045	Mason	19	OLY
049	Pacific	18 ½	SW
053	Pierce	18 ½	PS
055	San Juan	19 ½	PS
057	Skagit	19	PS
059	Skamania	18	SW
061	Snohomish	19	PS
067	Thurston	18 ½	OLY
069	Wahkiakum	18 ½	SW
073	Whatcom	19 ½	PS

OLY = Olympic Unit, PS = Puget Sound unit, SW = Southwest unit

Item 3--Plot number

A 3-digit code identifying the plot number of this location. Do not change the downloaded/printed code.

Item 4--Visit type

A 1-digit code describing what type of field measurements are being collected on the plot. Electronic data files for plots with Visit Type 3 to 6 will be output with a different file name so that the original data is preserved and can be used for quality control and statistical analysis.

Code	Visit type
1	Standard field plot/crew visit
2	QA "hot" check (original visit, with crew)
3	QA "hot" check (remeasurement visit, with crew)

4	QA "cold" check (remeasurement visit, without crew)
5	QA "blind" check (remeasurement visit by regular crew, without previous crew or previous crew data)
6	Reference plot (off of the plot-grid)

When collected: All plots
Field width: 1 digits
MQO: No errors
Values: 1 to 6

Item 5--DECLINATION

Record the azimuth correction used to adjust magnetic north to true north. All azimuths are assumed to be magnetic azimuths unless otherwise designated. This field carries a decimal place because the USGS corrections are provided to the nearest half degree. DECLINATION is defined as: DECLINATION = (TRUE NORTH - MAGNETIC NORTH)

In western Washington, DECLINATION will range from -019.5 to -018.0 degrees. The declination used for each plot will be downloaded/printed, and is listed by county in the table on page 23. This adjustment is made in the field by setting the declination for the plot as "**East Declination**" on the compass. Do not change the downloaded/printed code.

Item 6--Elevation

A 5-digit code downloaded/printed for the plot if recorded in a previous inventory. This item shows the elevation to the nearest 5-feet on the plot as obtained from a USGS topographic map. Do not change the downloaded/printed code. Leave this item blank if no code was downloaded/printed.

Item 7--Precipitation

A 3-digit code downloaded/printed for the plot if recorded in a previous inventory. This item shows average annual precipitation in inches on the plot. Do not change the downloaded/printed code. Leave this item blank if no code was downloaded/printed.

Item 8--Hydrologic unit code

A 12-digit code printed/downloaded for the plot. This item identifies the watershed in which the field grid point is located. Do not change the printed/downloaded code. Leave this item blank if no code was printed/downloaded.

Item 9--Special study 2000a

A 1-digit code downloaded/printed for the plot. This item identifies whether or not the plot area is within a roughly 30 mile range of the coast, and if qualifying trees on this plot are sampled for Platform and Moss Abundance (see page 113). Do not change the downloaded/printed code.

Code	Definition
Y	Qualifying trees are sampled for Platform and Moss Abundance
N	Trees are not sampled for Platform and Moss Abundance

Item 10--Cruiser names

Enter the first initial and last name of up to five people taking measurements on the plot.

When collected: All plots
Field width: 5 names of up to 12 characters
MQO: No errors
Values: List of crew names

DATE *OF OC4 INVENTORY*

Record the month, day, and year that the current plot visit occurred as follows:

Item 11--MONTH

Record the month that the plot visit occurred.

When collected: All plots
Field width: 2 digits
MQO: No errors
Values:

Month	Code		Month	Code		Month	Code
January	01		May	05		September	09
February	02		June	06		October	10
March	03		July	07		November	11
April	04		August	08		December	12

Item 12--DAY

Record the day of the month that the plot visit occurred.

When collected: All plots
Field width: 2 digits
MQO: No errors
Values: 01 to 31

Item 13--YEAR

Record the year that the plot visit occurred.

When collected: All plots
Field width: 4 digits
MQO: No errors
Values: *2000*

Item 14--Date of Oc3 inventory

4-digit code downloaded/printed if a date was assigned for the plot at Oc3. It indicates the month and year of the Oc3 inventory. Do not change the downloaded/printed date.

Item 15--Oc3 remeasurement period

A 2-digit code indicating the number of years used to determine the increment period between Oc3 and Oc4. The data recorder will automatically enter the measurement period for new and remeasured plots once the DATE OF OC4 INVENTORY is entered, but the crew should check that the remeasurement period is correct using the procedure on page 101.

Item 16--Oc3 ground land class

A 2-digit code is downloaded/printed for plots that were classified within inventoried area at Oc3. Do not change the downloaded/printed code.

Code	Oc3 ground land class	Definition
20	Timberland	Forest land which is potentially capable of producing at least 20 cubic feet/acre/year at culmination in fully stocked, natural stands of continuous crops of trees to industrial roundwood size and quality and which is not withdrawn from timber utilization. Industrial roundwood requires species that grow to size and quality adequate to produce lumber and other manufactured products (exclude fence posts and fuel wood which are not considered manufactured). Timberland is characterized by no severe limitations on artificial or natural restocking with species capable of

		producing industrial roundwood.
41	Other forest-rocky	Other forest land which can produce tree species of industrial roundwood size and quality, but which is unmanageable because the site is steep, hazardous, and rocky, or is predominantly nonstockable rock or bedrock, with trees growing in cracks and pockets. Other forest-rocky sites may be incapable of growing continuous crops due to inability to obtain adequate regeneration success.
44	Other forest-oak	Areas currently 10 percent or more stocked with forest trees, with low quality forest trees of oak, gray pine, madrone, or other hardwood species predominating, and which are not now, and show no evidence of ever having been, 10 percent or more stocked with trees of industrial roundwood form and quality. Trees on these sites are usually short, slow growing, gnarled, poorly formed, and generally suitable only for fuel wood. The following types are included: blue oak, white oak, live oak, oak-gray pine.
46	Other forest-unsuitable site	Other forest land which is unsuited for growing industrial roundwood because of one of the following environment factors: willow bogs, spruce bogs, sites with high water tables or even standing water for a portion of the year, and harsh sites due to climatic conditions. Trees present are often extremely slow growing and deformed. Examples: whitebark pine or mountain hemlock stands at timberline, shore pine along the Pacific Ocean, willow wetlands with occasional cottonwoods present, and sitka spruce-shrub communities bordering tidal flats and channels along the coast. Aspen stands in high-desert areas or areas where juniper/mountain mahogany are the predominate species are considered other forest-unsuitable site.
61	Cropland	
62	Improved pasture	
63	Natural range land	Includes abandoned farmland.
64	Farmland	Includes homesteads.
65	Marsh	
66	Cultural nonforest stringer	16.5-foot wide and wider constructed roads, power lines, pipelines and railroads.
67	Urban	Town sites and areas of clustered suburbs, residential industrial buildings. (Forest 7.5 ac. or more in urban areas are classed as forest land).
68	Naturally nonvegetated	Barren rock, sand, and glaciers.
69	Christmas tree lands	Includes nurseries.
92	Water	Includes lakes 1.0 to 40 acres and streams 30 to 660 feet wide.

Item 17--Oc3 plot type

1-digit code downloaded/printed which indicates the type of plot installed at Oc3. Do not change the downloaded/printed code.

Code	Oc3 plot type
1	5-subplot plot remeasured or reconstructed at Oc3
2	5-subplot plot new at Oc3
3	5-subplot plot "walk-through" at Oc3

Item 18--Landowner data request

1-character code which indicates if the landowner of the plot area requests data from the plot or publications of inventory data.

When collected: All plots
Field width: 1 character
MQO: No errors

Values:

Code	Landowner data request
0	No data request
1	Raw plot data and plotcard
2	Summarized plot data
3	Publications developed using plot information (when they become available in approx. 2002)
4	Raw plot data, summarized plot data
5	Raw plot data, publications
6	Summarized plot data, publications
7	All (raw plot data, summarized plot data, publications)

GPS COORDINATES

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field visited plot locations *(including Nonforest and Not in the sample plot locations).*

GPS UNIT SETTINGS, DATUM, and COORDINATE SYSTEM

Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured.

Use the NAD 27 Datum (also known as NAS-C or NA 27 CONUS/CLK66) *and* the UTM coordinate system.

See Chapter XII for instructions on setting up and using the PLGR GPS unit.

COLLECTING READINGS

Collect at least 180 GPS readings at the plot center *(the center of subplot 1)* which will then be averaged by the GPS unit. Each individual reading should have an error of less than 70 ft if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable readings (180 readings at error $\leq$ 70 ft) can not be obtained, try again before leaving the plot center.

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 ft of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. Use the Rng-Calc function in the PLGR *(see page 149)* to compute the coordinates of the plot center.

Coordinates may be collected further than 200 ft away from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Use the Rng-Calc function in the PLGR to compute the coordinates of the plot center.

In all cases try to obtain at least 180 readings before recording the coordinates.

Item 19--GPS UNIT *TYPE*

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

When collected: All field visited plots
Field width: 1 digit
MQO: No errors
Values:

Code	GPS UNIT *TYPE*
0	GPS coordinates not collected
1	Rockwell Precision Lightweight GPS Receiver (PLGR)

Item 20--GPS *UNIT* NUMBER

Record the 2-digit unit number of the PLGR. This number will be referenced to the serial number of the unit used.

When collected: When GPS UNIT *TYPE* > 0
Field width: *2 digits*
MQO: No errors
Values: *00 to 40*

Item 21--COORDINATE SYSTEM

Record a code indicating the type of coordinate system used to obtain readings.

When collected: When GPS UNIT *TYPE* > 0
Field width: 1 digit
MQO: No errors
Values:

2	UTM coordinate system

Item 22--UTM ZONE

Record a 2-digit and 1-character UTM ZONE as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 3 digits (##C)
MQO: No errors
Values: *10, 11, and U, T, or S*

Item 23--EASTING (X) UTM

Record the Easting coordinate of the plot center as determined by GPS.
The Husky data recorder will require that this item be entered two times. The first entry is the UTM as displayed on the PLGR. The second entry is the UTM numbers in reverse order (from right to left).

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
MQO: No errors
Values:

Item 24--NORTHING (Y) UTM

Record the Northing coordinate of the plot center as determined by GPS.
The Husky data recorder will require that this item be entered two times. The first entry is the UTM as displayed on the PLGR. The second entry is the UTM numbers in reverse order (from right to left).

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
MQO: No errors
Values:

Item 25--GPS ELEVATION

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

When collected: When GPS UNIT *TYPE* > 0
Field width: 6 digits
MQO: No errors
Values: -00100 to 20000

Item 26--GPS ERROR

Record the error as shown on the GPS unit to the nearest foot. As described *on page 27,* make every effort to collect readings only when the error ≤ 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record readings with an error of up to 999 ft.

When collected: When GPS UNIT *TYPE* > 0
Field width: 3 digits
MQO: No errors
Values: 0 to 70 if possible
71 to 999 if an error of less than 70 cannot be obtained

Item 27--NUMBER OF READINGS

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT *TYPE* > 0
Field width: 3 digits
MQO: No errors
Values: 1 to 999

Downloaded plot coordinates

For some plots, previous estimates of plot coordinates (pinprick location) may be available. These estimates come from several sources and will be of undocumented accuracy, but can be used as an aid in plot location. If available, the approximate plot coordinates will be downloaded to the data recorder and will be printed on the Oc4 plot data sheets. They can be saved as a waypoint on the PLGR and used to help locate the plot. Do not change any of the downloaded/printed plot coordinates codes.

Item 28--Previous UTM zone

A 2-digit and 1 character field indicating which UTM zone the plot is located in. If UTM Zone is not downloaded, it can be determined by turning on the PLGR GPS unit once in the plot area and viewing the UTM Zone of new readings. Correct entry of UM Zone is vital to use the PLGR for navigating.

Item 29--Previous Easting (X) UTM

A 7-digit code indicating the Easting as determined from USGS maps, aerial photos, or a previous plot visit.

Item 30--Previous Northing (Y) UTM

A 7-digit code indicating the Northing as determined from USGS maps, aerial photos, or a previous plot visit.

Item 31--Previous coordinates method

A 1-character code indicating the method by which previous plot coordinates were obtained.

Code	Previous coordinates method
D	Digitized from USGS maps
M	Digitized (MDSD) from PI photography (usually small scale)
P	Digitized (MDSD) from PLOT photography (usually large scale)
G	Collected at the plot location using a GPS unit

Item 32--Previous coordinates waypoint #

If the previous coordinates for this plot have been downloaded as a waypoint into the PLGR GPS unit, this item indicates the plot's 3-digit waypoint number in the PLGR. The waypoint name is in the format: C### P###

Reference point (RP) data items
Record the following items which describe the RP and the course from the RP to the plot as described on page 18. These data should match what is recorded on the paper Plot Card form.

Item 33--RP species
If the RP is a tree or stump record it's species code (see page 99). If it is not, record 999.

Field width: 3 digits
MQO: No errors

Item 34--RP diameter
If the RP is a tree or stump record it's diameter (see page 102). Diameter may be estimated to the nearest inch. If it is not a tree or stump record 999.

Field width: 4 digits
MQO: +/- 10%

Item 35--RP azimuth
Record the azimuth from the RP to the plot.

Field width: 3 digits
MQO: +/- 4 degrees

Item 36--RP distance
Record the slope distance from the RP to the plot. Record to the nearest foot.

Field width: 4 digits
MQO: +/- 5%

Item 37--RP az/dist to subplot #
Record the 1-digit number of the subplot which is referenced from the RP. Reference to subplot 1 whenever possible.

Field width: 1 digit
MQO: No errors
Values: 1 to 5

Item 38--Plot card data items
The following items are collected and recorded on the paper Plot Card form:

Cruiser names
Record the first and last names of all people collecting data on the plot.

RP description
Record a description of the RP and course to the plot from RP to plot as described on page 18.

Plot write up
Provide a written description of the plot area. The description normally includes an explanation of the site productivity, treatment, insect/disease, harvest, ownership class, and any other items of note that might be used by an analyst examining discrepancies in the plot data or by a person trying to relocate the plot at a future time.

Items for office attention
Note of any data items that need to be changed or checked after the plot is received at the office.

V. SUBPLOT ATTRIBUTES

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V. SUBPLOT ATTRIBUTES

Subplot attributes record important information about the physical setting of the plot and the presence and location of contrasting land types on the plot. This information is used for a variety of topics, including: calculating accurate area estimates of land types and their associated forest information (e.g. tree volume, disease), identifying potential limits to management (e.g. topography), and relating physical site features to forest composition and productivity.

A. Subplot identification

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the *seedling/sapling* plot, since that plot is contained within the subplot perimeter. If the subplot center cannot be accessed, do not collect and record data on the subplot.

Item 1--SUBPLOT NUMBER

Record a 2-digit code for each subplot that is assessed at Oc4. The second digit is the Oc4 subplot. At this inventory the first digit is also the Oc4 subplot (this is referred to as a " ## " subplot). Other first digit codes (N, C, or R) may be valid for other inventories. See Chapter III for instructions regarding for instructions on which, if any of the 5 Oc3 subplots to remeasure. See the plot diagram on page 16.

When Collected: All *established* subplots
Field width: *2 digits*
MQO: No errors
Values:

Code	Subplot
11	subplot 1
22	subplot 2
33	subplot 3
44	subplot 4
55	subplot 5

Item 2--SUBPLOT CENTER CONDITION

Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

When collected: All *established* subplots
Field width: 1 digit
MQO: No errors
Values: 1 to 9

B. Physioclass information

Aspect, slope, and physiographic class are recorded by subplot as well as by (forest) condition class. Code these items for each established subplot if one or more accessible forest land condition classes are present within the subplot's fixed-radius plot, i.e., if all condition classes present on a subplot are nonforest land, leave aspect, slope, and physiographic class blank. Physioclass data by subplot aids in determining these variables by forest condition class.

Aspect and slope were recorded by subplot on forested plots visited at Oc3. These Oc3 data are downloaded/printed. If the subplot center is in condition class number 1, and condition class number 1 is accessible forest land, update Oc3 aspect and slope, and add codes for physiographic class, water type, and distance.

Item 3--SUBPLOT ASPECT

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform

direction. SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope. If aspect changes gradually across the subplot, record an average aspect. If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.

If the subplot falls on or straddles a canyon bottom or narrow ridge top, code aspect as follows:

- Code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

When the Oc3 aspect data is downloaded/printed it requires updating, replace the 2-character code used at Oc3 with an Oc4 3-digit numerical code

When collected: All ## subplots with an accessible forest land condition class
Field width: 3 digits
MQO: +/- 10 degrees
Values:

Code	Aspect
000	no aspect, slope < 5 percent
001	1 degree
002	2 degrees
*	*
*	*
360	360 degrees, due north

Item 4--SUBPLOT SLOPE

Record the angle of slope across the subplot to the nearest 1 percent. SUBPLOT SLOPE is determined by sighting the clinometer along a line parallel to the average incline (or decline) of each subplot. This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure SUBPLOT SLOPE, Observer 1 should stand at the uphill edge of the subplot and sight Observer 2, who stands at the downhill edge of the subplot. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

If slope changes gradually across the subplot, record an average slope. If slope changes across the subplot but the slope is predominately of one direction, code the predominate slope percentage rather than the average. If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the slope as follows:

- If the subplot falls directly between two side hills, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

When collected: All ## subplots with an accessible forest land condition class
Field width: 3 digits
MQO: +/- 10%
Values: 000 to 155

Item 5--Subplot PHYSIOGRAPHIC CLASS

Record the code that best describes the PHYSIOGRAPHIC CLASS of the subplot; land form, topographic position, and soil generally determine physiographic class. As a rule of thumb, look over the annular plot area to determine physiographic class, but always use your best judgment.

When collected: All ## subplots with an accessible forest land condition class
Field width: 2 digits
MQO: No errors
Values:

Xeric -- Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.

Code	Physiographic class	Description
11	Dry Tops	Ridge tops with thin rock outcrops and considerable exposure to sun and wind.
12	Dry Slopes	Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most mountain/steep slopes with a southern or western exposure.
13	Deep Sands	Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams.
14	Other Xeric	All dry physiographic sites not described above.

Mesic -- Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.

Code	Physiographic class	Description
21	Flatwoods	Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.
22	Rolling Uplands	Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated floodplains.
23	Moist Slopes and Coves	Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.
24	Narrow Floodplains/ Bottomlands	Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs
25	Broad Floodplains/ Bottomlands	
26	Other Mesic	All moderately moist physiographic sites not described above.

Hydric -- Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where excess water seriously limits both growth and species occurrence.

Code	Physiographic class	Description
31	Swamps/Bogs	Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.
32	Small Drains	Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.
33	Bays and wet pocosins	Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include sites in the Lake States with lowland swamp conifers or the Carolina bays in the southeast US.
34	Beaver ponds	
35	Cypress ponds	
36	Other hydric	All other hydric physiographic sites

C. Water information
Information on water is used to analyze adjacent forest land. The same water source may be recorded on multiple subplots.

Item 6--WATER ON *SUB*PLOT

Record a 1-digit code describing the type of water within 215 feet (horizontal distance) of the subplot center. See the definitions on page 52.

When collected: All ## *sub*plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors
Values:

Code	Water on *sub*plot
0	None -- no water sources
1	Permanent *(year-round)* streams or ponds too small to qualify as noncensus water
2	Permanent water (too small to qualify as Census or noncensus water) in the form of deep swamps, bogs, marshes without standing trees present or with standing trees and less than 1.0 ac in size
3	Ditch/canal – human made channels used as a means of moving water, such as irrigation or drainage which are too small to qualify as noncensus water
4	Temporary *(intermittent)* streams
5	Flood zones – evidence of flooding when bodies of water exceed their natural banks
9	Other temporary water – specify in field notes

Item 7--Water proximity

Record a 3-digit code indicating the horizontal distance in feet from the edge of the water source to the subplot center. If there is no water source within 215 feet horizontal distance of subplot center, record "000".

When collected: When WATER ON *SUB*PLOT > 0
Field width: 3 digits
MQO: +/- 10%
Values: 0 to 215

D. BOUNDARY REFERENCES
Boundary reference data are used to remeasure plots and to compute the area for the condition classes sampled on a plot. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and *seedling/sapling* plots. Boundaries outside sampled (fixed-radius) areas are not referenced.

In addition to the recording procedures described herein, sketch maps of condition class boundaries onto the pre-printed plot diagrams on field tally sheets.

REFERENCE PROCEDURE
Reference, within the sampled area on each *seedling/sapling* plot *and* subplot, the approximate boundary of each condition class that differs from the condition class at a subplot center. Trees selected on these fixed-radius plots are assigned to the actual condition in which they lie regardless of the recorded approximate boundary.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points (page 38). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference, and one "corner" point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

Refer to the general mapping guidelines for Condition Status and Accessible Forest Land on pages 47 and 53. The following additional rules apply when referencing a boundary within a subplot *or seedling/sapling* plot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water's edge along a stream course, ditch, or canal.

2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge.

3. When a boundary between two contrasting forest land condition classes is not clearly marked, map along the stems of the contrasting condition. When the boundary between two contrasting forest land condition classes is separated by a narrow linear inclusion (creek, fire line, narrow meadow, unimproved road), establish the boundary at the far edge, relative to subplot center, of the inclusion.

4. When a plot is remeasured, the crew will examine the boundaries referenced at last inventory. If no change has occurred, the current crew will retain the boundary data that were recorded at last inventory. If a boundary has changed, or a new boundary is present, or the previous crew made an obvious error, record new or updated boundary data. Delete boundaries that are no longer distinct.

5. Although individual MQOs are specified for the azimuths and distances, in practice a crew will be considered 'correct' when the difference in areas as mapped by the original crew and by the QA crew is less than 10% of the subplot or *seedling/sapling* plot area. This allows for slight variations in azimuths or distances due to the approximate nature of our mapping procedures.

BOUNDARY DATA

Record the appropriate value *for each of the following data items* for each boundary mapped on the subplot *or seedling/sapling* plot as follows.

If no boundaries are recorded for a subplot, enter one record with PLOT TYPE = 0.

Item 8--SUBPLOT NUMBER

Record the code corresponding to the number of the subplot. *Use the same code used for SUBPLOT NUMBER on page 33.*

Field width: *2 digits*
MQO: No errors
Values: *11, 22, 33, 44, 55*

Item 9--PLOT TYPE

Record the code to specify whether the boundary data are for the *55.8 ft. subplot or the 10.8 ft seedling/sapling plo*t. *If no boundaries are recorded for a subplot, enter one record with PLOT TYPE = 0.*

Field width: 1 digit
MQO: No errors
Values:

Code	Plot Type
0	*no boundaries are recorded for the subplot*
1	*55.8'* subplot boundary

2	*10.8' seedling/sapling* plot boundary

Item 10--CONTRASTING CONDITION

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center e.g., the condition class present on the other side of the boundary line.

Field width: 1 digit
MQO: No errors
Values: 1 to 9

Item 11--LEFT AZIMUTH

Record the azimuth from the subplot center to the farthest left point (facing the contrasting condition class) where the boundary intersects the subplot *or seedling/sapling* plot circumference.

Field width: 3 digits
MQO: +/- 10 degrees
Values: 001 to 360

Item 12--CORNER AZIMUTH

Record the azimuth from the subplot center to a corner or curve in a boundary. If a boundary is best described by a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

Field width: 3 digits
MQO: +/- 10 degrees
Values: 000 to 360

Item 13--CORNER DISTANCE

Record the horizontal distance, to the nearest 1 ft, from the subplot center to a boundary corner point.

When collected: All boundaries when CORNER AZIMUTH > 000
Field width: *3 digits*
MQO: +/- 1 ft
Values:

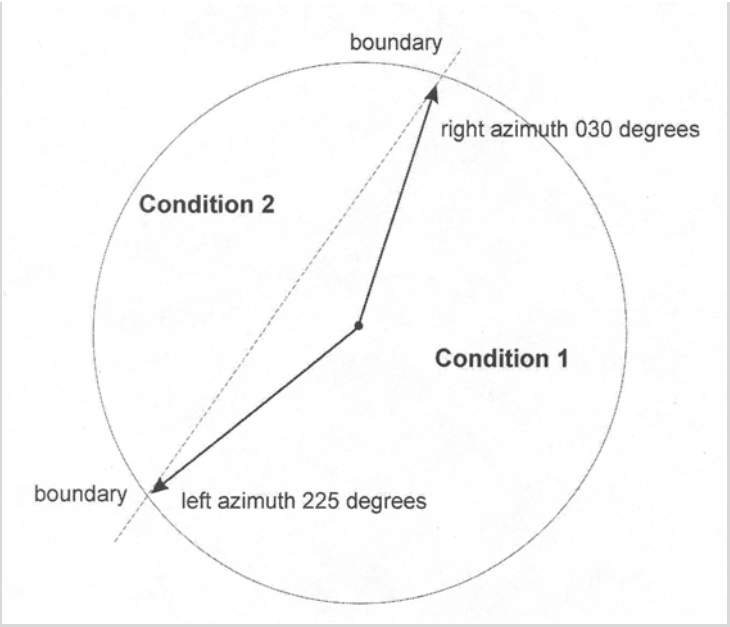
Plot Type	Values for Corner Distance
10.8' seedling/sapling plot	*0.1* to *10.8* ft.
*55.8' sub*plot	*0.1 to 55.8* ft.

Item 14--RIGHT AZIMUTH

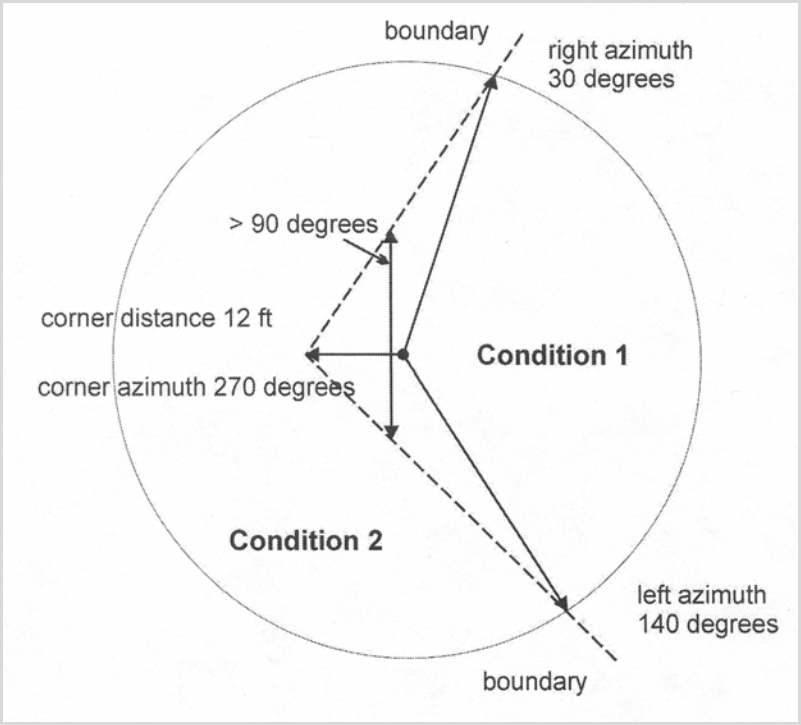
Record the azimuth from the subplot center to the farthest right point (facing the contrasting condition class) where the boundary intersects the subplot or *seedling/sapling* plot circumference.

Field width: 3 digits
MQO: +/- 10 degrees
Values: 001 to 360

Boundary mapping examples



How to measure a straight boundary on a seedling/sapling plot or subplot.



How to measure a boundary with a corner on a seedling/sapling plot or subplot.

E. Nonforest inclusions

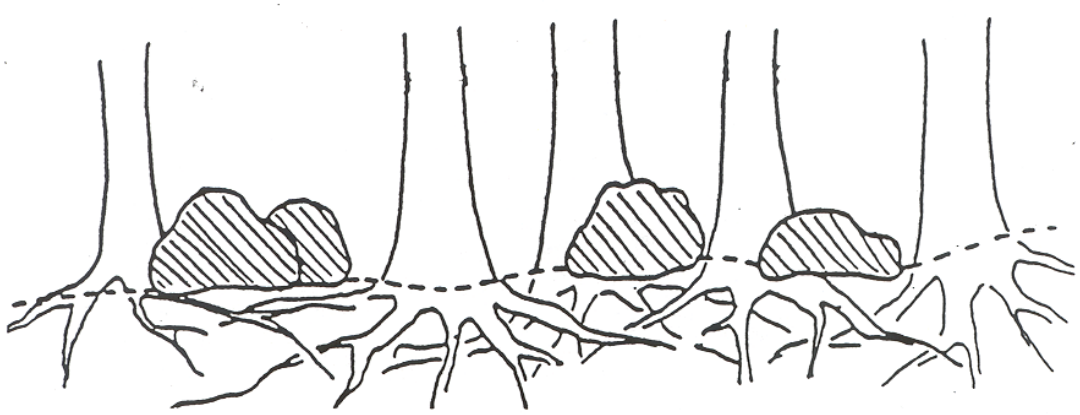
Nonforest inclusions are areas that are nonforest but are too small by definition to qualify as a separate nonforest condition class. These inclusions are inherently incapable of supporting tree stocking at 10 percent or more of normal full stocking for the life of a stand. Examples of nonforest inclusions can be unimproved dirt lanes, small streams, and sites with standing or running water, a high water table, a rock outcropping occupying at least 65 square feet, severe soil compaction (i.e. an old landing), or mass soil movement (slips, slides, or slumps). A stream or improved road which qualifies as nonforest land should be recognized as a separate nonforest condition class and not as a nonforest inclusion.

1. General instructions
Nonforest inclusions are mapped and recorded on established (##) subplots for condition class number 1. This is done only if the nonforest inclusion is present within the mapped accessible forest land condition class and is partially or entirely within the subplot's 55.8-foot fixed-radius plot.

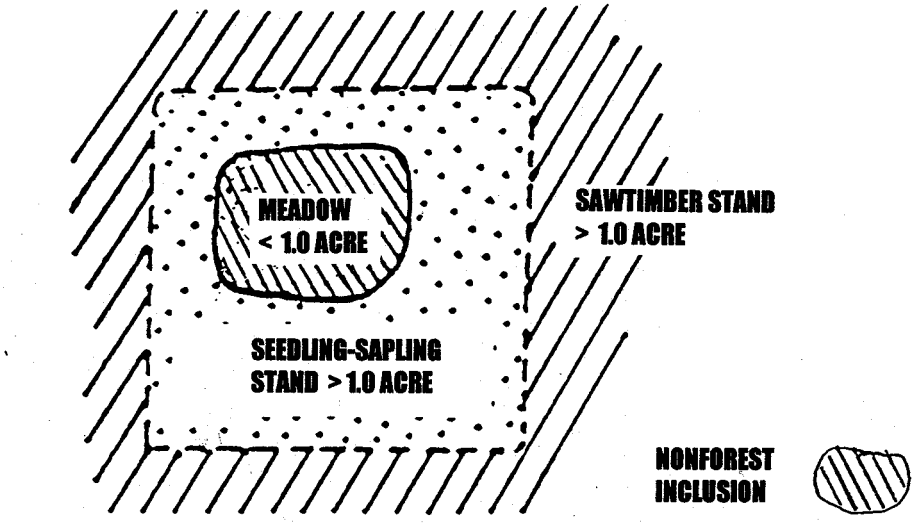
Map and label nonforest inclusions lying within the 55.8-foot fixed-radius plot on the subplot diagram. For condition class number 1, estimate the percentage of the 55.8-foot fixed-radius plot area occupied by the mapped nonforest inclusions; see page 43 for how to map and estimate percentages. Record these percentages, their assigned forest condition class number (1) and the type(s) of inclusion under "Inclusions %" on the subplot diagram. Then, record, for condition class number 1, the total percentage and assigned condition class number under "Nonforest inclusions" within SUBPLOT ATTRIBUTES. Record "00" in the "%" column for condition class 1 if there are no without inclusions, or set condition class and % to blank.

When collected: All established (##) subplots
Field width: 2 digits
MQO: +/- 15%
Values: 1 to 99

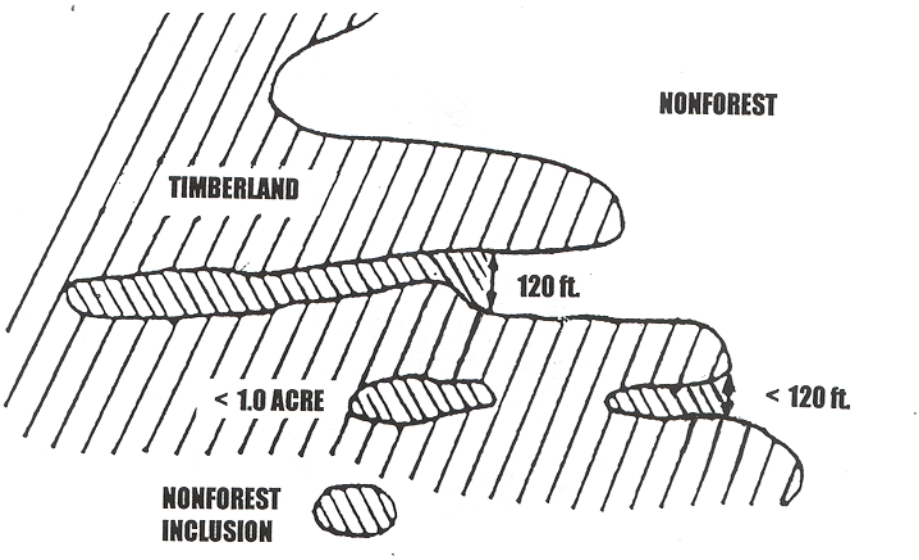
2. Downloaded estimates of nonforest inclusions
Nonforest inclusions were mapped and recorded by subplot on timberland plots visited at Oc3. These Oc3 data are downloaded/printed. If data for Oc3 nonforest inclusions are downloaded, revise the Oc3 estimate for condition class number 1. If there are no nonforest inclusions present, set the downloaded estimate to "00".



Example: Large, scattered boulders cover 25 percent of the 55.8-foot fixed-radius subplot. However, tree roots can fully utilize the space beneath the boulders. The boulders thus have no effect on potential tree stocking, and the item is coded "00" and the rocks are not mapped on the 55.8-foot fixed-radius subplot diagram as nonforest inclusions.



Example: A swampy meadow less than 1.0 acre in area is surrounded by forest land that is greater than 1.0 acre. The meadow is a nonforest inclusion, and the portion of the meadow within the 55.8-foot fixed-radius plot is mapped as a nonforest inclusion on the subplot diagram.



Example: In the above example each nonforest area (see Chapter III) is classified as accessible forest land because each is not 120.0 ft. wide and 1.0 acre in size. They would be mapped as nonforest inclusions. Where the nonforest area becomes greater than 120.0 feet wide is classified as a part of the nonforest condition class and it would not be mapped as a nonforest inclusion.

F. Root disease mapping

Root diseases, especially laminated root rot, are serious forest pathogens in western Washington. Information collected about root disease is developed into estimates of the area affected by each of several major diseases. These estimates can be combined with other data from the inventory to analyze the impact of root disease on forest land.

1. General instructions

Root diseases are mapped and recorded on established (##) subplots. Each disease is mapped and recorded separately (see "Mapping root disease on page 42). A root disease is mapped and recorded

only if the area of infection is partially or entirely within a subplot's 55.8 ft. fixed-radius plot and is within condition class number 1.

Map and label each disease present within the 55.8 ft. subplot on the subplot diagram. For condition class number 1, estimate the percentage of the 55.8 ft. fixed-radius plot area occupied by each mapped root disease; see pages 42 and 43 on how to map and estimate percentages. By disease, record these percentages, their assigned forest condition class number (1) and the root disease code under "Root Disease" on the subplot diagram; enter "NO" if no disease is present. Then record, for condition class 1, these percentages, and their assigned condition class number (1), and the disease code under "Disease 1, 2, or 3" within SUBPLOT ATTRIBUTES. Record a disease code of "NO" (no disease) and "00" in the "%" column for each disease and condition class without disease present.

When collected: All established (##) subplots
Field width: 2 digits
MQO: +/- 15% for each root disease
Values: 1 to 99

2. Downloaded estimates of root disease
Root diseases were mapped and recorded individually by subplot on timberland plots visited at Oc3. These Oc3 data are downloaded/printed. If data for Oc3 root diseases are downloaded, revise the Oc3 estimate for condition class number 1 to reflect the situation at Oc4. Revise only if 1) the area affected by a disease present at Oc3 has changed by ≥20 percent since Oc3 or 2) if a root disease was absent at Oc3 but now is present in condition class 1 within the 55.8 ft. fixed-radius plot. Always map the current extent of root disease regardless of the "20-percent rule".

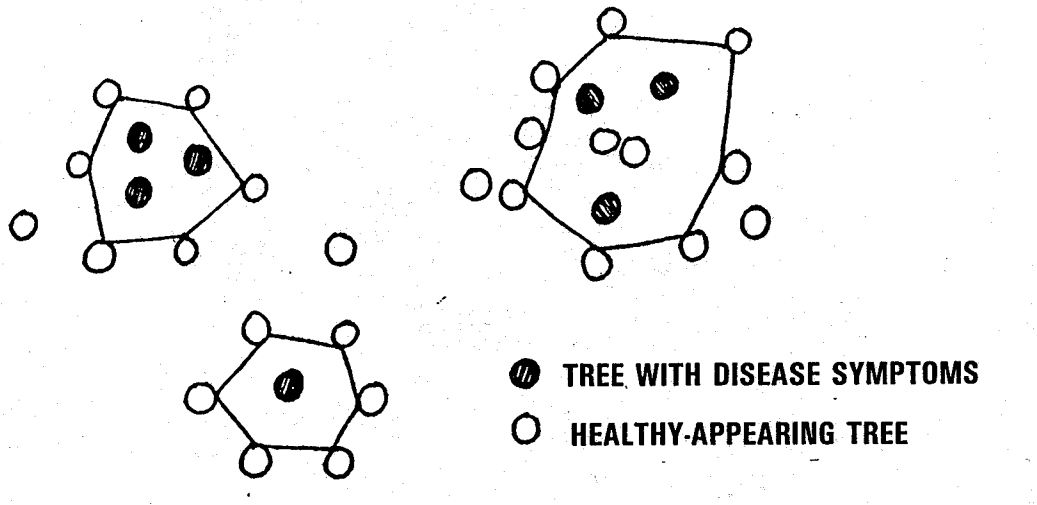
If there are no root diseases present, set the downloaded disease code(s) to "NO" (no disease) and the % estimate(s) to "00"%.

3. Mapping root diseases
Define the boundary of an infection zone using straight lines connecting the boles of healthy-appearing trees on the perimeter of a root disease center. A healthy-appearing tree is defined by the following criteria:

a) the tree lacks crown symptoms of root disease (reduced terminal growth increment, thinning or yellowing crown, or a distress cone crop present);
b) the tree has a root disease-infected tree as its nearest neighbor on the side facing the infection center; and
c) the tree has a healthy tree as its nearest neighbor on the side facing away from the infection center.

When determining the area infected by a root disease, do not exclude an island of healthy-appearing trees inside the infected area unless the trees in the island are all of non-host species; susceptible trees in an "island" are likely to be infected. Tally trees may require damaging agent and severity coding for root disease; this includes cases where a tally tree is not within the boundary of a mapped infection zone but, because of proximity to an infected tree or stump, requires a root disease agent code that has a severity rating of 1 (see page 118).

The following diagram shows how infection center boundaries would be defined in several situations.



Mapped area of infection should include conifer sites that have no conifers present due to root disease. When mapping areas of infection, do not include areas of nonforest inclusions or area that will not support susceptible host species.

Map and estimate percent cover only if a disease is a primary cause of tree death. Do not map and estimate percent cover for secondary infections (e.g. Armillaria that invaded a tree that was killed by Phellinus). If you find evidence of a secondary agent, note the situation in Present Condition/Past Disturbance.

Sketch the boundaries on the subplot map diagram; shade the infected area, and label with the appropriate code:

Code	Causal fungus	Disease
PW	Phellinus weirii	laminated root rot
CW	Ceratocystis wagneri	black stain root disease (do not map)
FA	Fomes annosus	annosus root rot
AM	Armillaria ostoyae(mellea)	armillaria root disease
UK	Unknown	--
NO	None present	--

If there is evidence of root disease, but the specific disease cannot be identified, enter "UK" (unknown) for the disease code. Do not map or record Phytophthora lateralis (Port-Orford-cedar root rot) on the subplot diagram.

4. Guide for identifying root diseases
See Appendix 12 for insect and disease identification information.

G. Estimating and recording area percentages by condition class
The percentage of the area that each mapped condition class on a subplot occupies will be calculated in the office using the boundary information. Use the following steps to estimate, by condition class, the percentage of subplot area mapped as nonforest inclusion and/or root disease.

1. Each dark dot on the mapping section of the Plot Card represents 0.22 percent of the area within the 55.8 ft. radius subplot.

2. Draw the nonforest inclusion or root disease boundary and count the number of dark dots within the boundary. Count every other dark dot of those which fall directly on a boundary.

3. Multiply the number of dark dots from (b) by 0.22 to get percent of the subplot in that condition class. Alternatively, count the number of dark dots from (b); divide by 454 (total number of dark dots in a circle) and multiply by 100 to get the percent of the subplot in that condition class. See the legend on the diagram plot card.

VI. CONDITION CLASS ATTRIBUTES

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VI. CONDITION CLASS ATTRIBUTES

Condition class attributes record information about the land type that allows grouping and analysis of similar land types. They also record information about forest structure, composition, and disturbance, which allows analysts to group similar forest types, understand management practices used by different landowners, examine effects of disturbance, and classify land types on which little data is collected--for example, when a condition class only occurs on a small portion of one subplot.

On revisited plots, some attributes were recorded at Oc3 and are downloaded/printed for condition class 1. Some may require updating.

Condition classes are delineated in three steps:

(1) Plot area is divided into condition classes based on differences in condition status.
(2) Accessible forest land condition classes condition status are further divided by differences in 6 mapping variables.
(3) Nonforest land condition classes are further divided, in some cases, by differences in nonforest land use.

Item 1--CONDITION CLASS NUMBER

On a plot, assign and record a unique identifying number for each condition class. At the time of the plot establishment, the condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated. On a plot, each sampled condition class must have a unique number that can change at remeasurement to reflect new conditions on the plot.

When collected: All condition classes
Field width: 1 digit
MQO: No errors, 100% of time
Values: 1 to 9

CONDITION STATUS

The first step in delineating condition classes is to recognize differences in CONDITION STATUS.

Item 2--CONDITION STATUS

Record the code that describes the status of the condition. Record for all condition classes sampled on a plot. The instructions following apply when delineating condition classes that differ by CONDITION STATUS.

When collected: All condition classes
Field width: 1 digit
MQO: No errors
Values:

CODE	CONDITION STATUS
1	Accessible forest land
2	Nonforest land
3	Noncensus water
4	Census water
5	Denied access area
6	Hazardous
7	Not in the sample

Instructions for determining condition classes differing in <u>condition status</u>:
The following guidelines, and those regarding boundaries listed on page 54 apply when delineating condition classes that differ by condition status.

The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 1.0 ac in size, and each is at least 120.0 ft in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 ac in size and less than 120.0 ft in width are considered forest land and are not delineated and classified as a separate nonforest condition class.

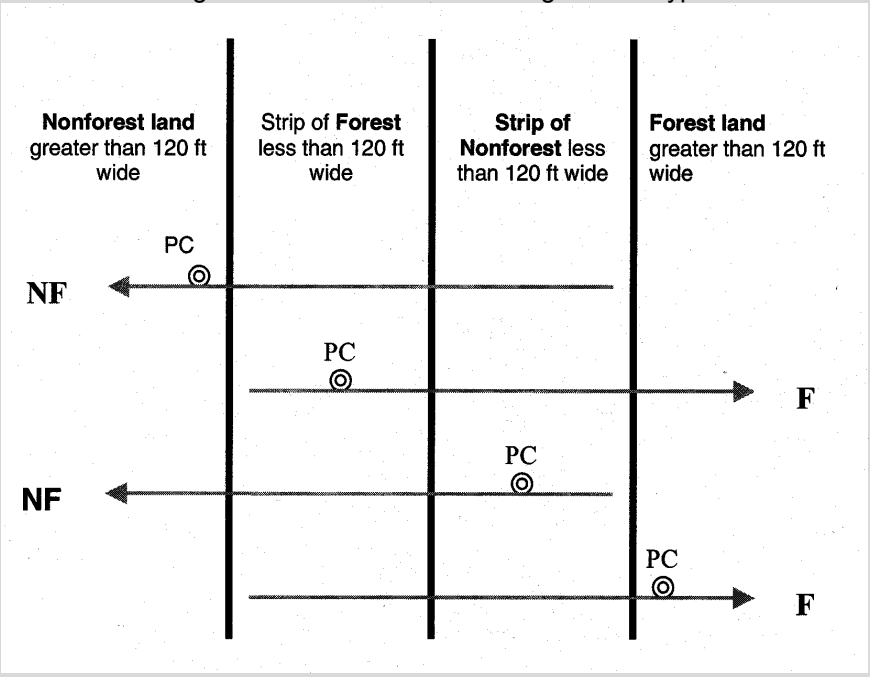
Within a nonforest land condition class, forested areas or linear strips of trees less than 1.0 ac in size and less than 120.0 ft in width are considered part of the nonforest condition class.

Five exceptions to these size and width requirements apply:

1. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is less than 1.0 ac in size and less than 120.0 ft in width. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement.

   For many small intermingled strips, determine the total area that the alternating strips occupy, and classify according to the CONDITION STATUS (forest land or nonforest land) that occupies the greater area. If the area of alternating strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.

   For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see *the figure below*. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.



Example of alternating strips of forested and non forested conditions

2. Developed nonforest inclusions: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 ac in size and 120.0 ft in width and are surrounded by forest land. All extensions from developed nonforest inclusions are nonforest condition classes regardless of length or width. There are three kinds of developed nonforest inclusions that do not have to meet area or width requirements.

a) Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. *Generally constructed using machinery. The area where the original topography has been disturbed by cutbanks and fill is considered part of the road.* Unimproved traces and roads created for skidding logs are not considered improved roads.

b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs.

c) Developments: structures and the maintained area next to a structure, all less than 1.0 ac in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds.

3. The 120 foot minimum width for mapping does not apply when a corner angle is 90 degrees or greater.

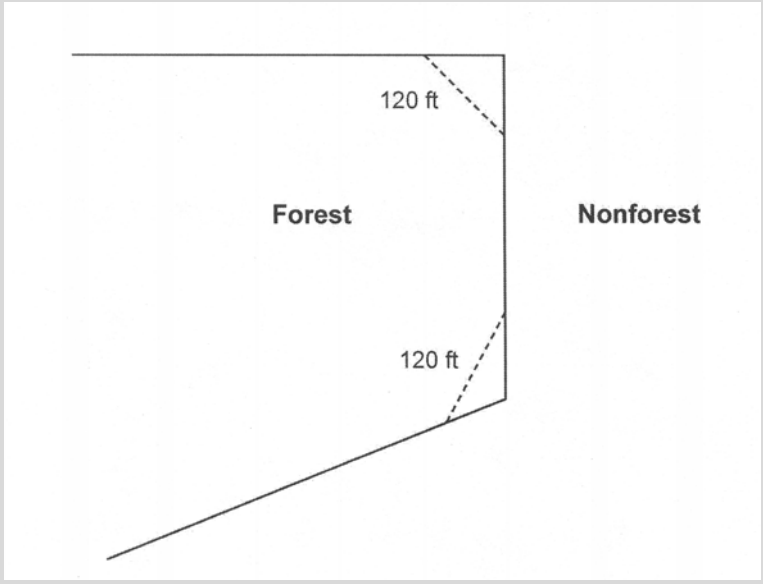


Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 ft wide and cover at least 1.0 ac. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features which do not meet the definition for Census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 ac requirement; use professional judgment and common sense on any linear water feature. *A 30 ft wide stream needs to be 1450 ft long to be an acre in size.*

5. Riparian forest area: A riparian forest area is defined as a forest area between 30.0 and 120.0 ft wide, and 1.0 ac or more in size, cumulative, but not necessarily present on both sides of and adjacent to a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated “within

forest" and contain at least one distinct and obvious change in a condition class mapping attribute from its adjacent accessible forest land condition class.

Condition Status definitions:

1. Accessible forest land

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets at least one of the two following criteria:

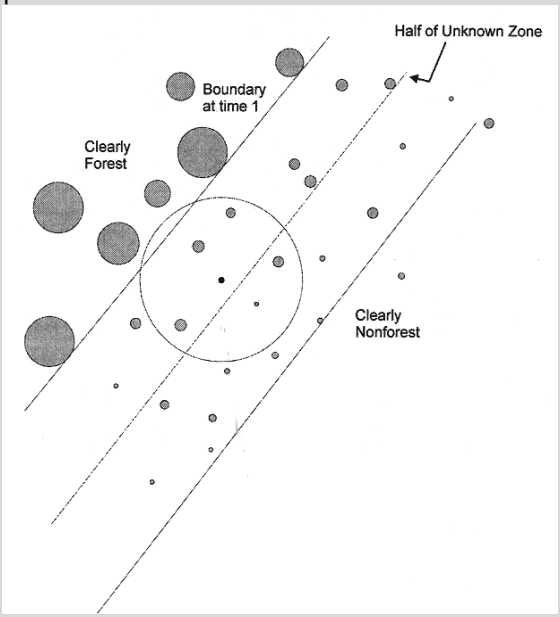
(a) the condition is at least 10-percent stocked by trees of any size (see page 99), or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities;

or

(b) in several western woodland types *(none of which will be encountered in western Washington)* where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.

To qualify as forest land, the prospective condition must be at least 1.0 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

Transition zones and forest/nonforest encroachment. When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10% minimum forest land stocking, and where it clearly is less than required stocking; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line.



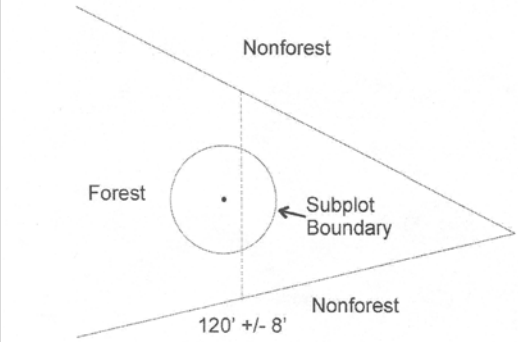
Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment is clearly stocked where it meets the

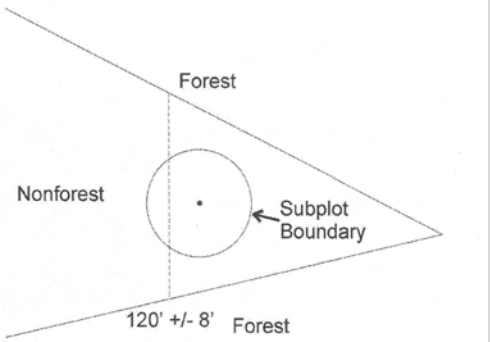
nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone is not clearly stocked where it meets the nonforest, determine where it is clearly stocked (forest) and where it is clearly not stocked (nonforest); divide this zone in half, and classify the entire subplot based on which side of the line the subplot center falls.

Treated strips – Occasionally, crews will come across plantations of trees, in which rows of trees alternate with strips of vegetation that have been bulldozed, mowed, tilled, treated with herbicide, or crushed. Because these strip treatments are conducted to optimize growth or to release the stand, the areas are considered forest land, and the treatment is considered a timber stand improvement operation. Do not confuse these practices with similar treatments on nonforest lands such as yards or rights-of-way. Contact with the land owner may help determine the intent of a treatment.

Indistinct boundary due to the condition minimum-width definition: Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 ft) definition. Although the point where the definition changes from forest to nonforest creates an invisible "line" between conditions, **this definitional boundary is not distinct and obvious**. See *the figures below*. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.



Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 feet wide. In this example the entire subplot is classified as forest.



Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the non forest narrows to 120.0 feet wide. In this example the entire subplot is classified as forest.

Land may be developed for nonforest use even though tree cover is present. Indications of nonforest use may include the presence of fences or structures, the clearing of stumps, extreme grazing, the absence of forest vegetation, evidence of human habitation and use around maintained structures such as landscaping, gardens, lawns, and play areas. The absence of forest vegetation means that some or all layers of the vegetation present--trees, shrubs and forbs--differ from what one would expect on forest land undisturbed by nonforest use; for example, a fenced, farm-lot may have forest trees present, but if extreme, sustained grazing has severely diminished or eliminated forest shrub and forb communities and tree regeneration is stifled, the farm-lot is likely nonforest. (In the Pacific Northwest, grazing, common on forest lands, is rarely reason to classify a plot as "developed for nonforest use" unless a situation similar to the example is encountered).

2. Nonforest land

Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the *other* CONDITION STATUS values defined *below*. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, with 5 exceptions discussed *starting on page 47*. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next occasion to see if it has become forest land.

On all field visited plots, map all nonforest condition classes present on the 55.8-foot fixed-radius at each established subplot. Do not combine nonforest condition classes present. Example: if nonforest--urban land and nonforest--cropland are both present within a 55.8-foot fixed-radius plot, map each land class as a separate condition class.

All Nonforest land condition classes are assigned a use code see Item 31--PRESENT NONFOREST LAND USE on page 66.

3. Noncensus water

Lakes, reservoirs, ponds, and similar bodies of water 1.0 ac to 4.5 ac in size. Rivers, streams, canals, etc., 30.0 ft to 200 ft wide.

4. Census water

Lakes, reservoirs, ponds, and similar bodies of water 4.5 ac in size and larger; and rivers, streams, canals, etc., more than 200 ft wide (1990 U.S. Census definition).

If the field grid location (the center of subplot 1), lands in Census Water, the entire plot is considered Census Water and is classified as a condition class with CONDITION STATUS = 4. No field measurements are made on that plot.

If a subplot center (2 to 5) lands in Census water, the entire subplot is considered Census water and is classified as a condition class with CONDITION STATUS = 4 (Census water). No field measurements are made on that subplot.

If the center of a subplot is accessible, but the subplot has Census water present within it's 55.8-foot fixed-radius plot, 1) map the Census water area as a separate condition class. 2) record the segment lengths of any CWD transects that extend into the Census water condition class. 3) use normal procedures to map and measure other condition classes.

5. Denied access

Any area within the sampled area on a plot on which access is denied by the legal owner of the land the plot falls on, or by an owner of the only reasonable route to the plot. There are no minimum area or width requirements for a condition class delineated by denied access.

If access is denied to the field grid location (the center of subplot 1), the entire plot is considered access denied and is classified as a condition class with CONDITION STATUS = 5 (denied access). No field measurements are made on that plot. Also see the procedures on page 67.

If a subplot center (2 to 5) lands in a access denied area, the entire subplot is considered access denied and is classified as a condition class with CONDITION STATUS = 5 (denied access). No field measurements are made on that subplot.

If the center of a subplot is accessible, but the subplot has access denied area present within it's 55.8-foot fixed-radius plot, 1) map the access denied area as a separate condition class, 2) record the segment lengths of any CWD transects that extend into the access denied condition class. 3) use normal procedures to map and measure other condition classes.

6. Hazardous

Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal plantations, temporary high water, etc. Although the

hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.

A plot or subplot is hazardous according to the crew's judgment.

If the field grid location (the center of subplot 1), is hazardous, the entire plot is considered hazardous and is classified as a condition class with CONDITION STATUS = 6 (hazardous). No field measurements are made on that plot.

If a subplot center (2 to 5) lands in a hazardous area, the entire subplot is considered hazardous and is classified as a condition class with CONDITION STATUS = 6 (hazardous). No field measurements are made on that subplot.

If the center of a subplot is accessible, but the subplot has hazardous area present within it's 55.8-foot fixed-radius plot, 1) map the hazardous area as a separate condition class, 2) record the segment lengths of any CWD transects that extend into the hazardous condition class. 3) do not estimate, or 'rough in' tree, vegetation, or other data on the hazardous portion. 4) follow normal field instructions to the extent safely possible to map and measure other condition classes.

7. Not in the sample

Any area within the sampled area on a plot that is not within the boundaries of the sample population of interest. Examples of areas out of the sample would be plots or portions of plots falling in Mexico, Canada, and areas which are not currently participating in FIA such as National Forest land in California, Oregon, Washington, or BLM land in western *Oregon*. A condition outside the sample area remains in the potential population of interest and is re-examined at the next occasion to determine if it becomes part of the population of interest. There are no minimum size or width requirements for a condition class delineated as out of the sample.

If the field grid location (the center of subplot 1), is Not in the Sample, the entire plot is considered Not in the Sample and is classified as a condition class with CONDITION STATUS = 7 (Not in the Sample). No field measurements are made on that plot.

All Not In The Sample area is mapped as a condition class with a Condition Status of 7. Other condition classes are mapped according to normal field instructions and measurements are taken in any accessible forest land condition classes. This instruction applies if the subplot center falls in, or not in, the Not In the Sample area.

If the center of a subplot is accessible, but the subplot has Not in the Sample area present within it's 55.8-foot fixed-radius plot, 1) map the Not in the Sample area as a separate condition class, 2) record the segment lengths of any CWD transects that extend into the Not in the Sample condition class. 3) use normal procedures to map and measure other condition classes.

MAPPING (CONDITION CLASS DEFINING) VARIABLES for accessible forest land:

Instructions: Determining condition classes <u>within accessible forest land</u>:

Any condition class sampled as accessible forest land *(Condition Status = 1)* may be further subdivided, **in order of listed priority**, into smaller condition classes if distinct, contrasting condition classes are present because of variation within the sampled area in any of the following attributes:

RESERVED STATUS
OWNER GROUP
FOREST TYPE
STAND SIZE CLASS
REGENERATION STATUS
TREE DENSITY

Specific criteria apply for each of the six attributes and are documented by attribute in Items 3 to 8. "Stands" are defined by plurality of stocking for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 ac in size and at least 120.0 ft in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained.

No other attribute shall be the basis for recognizing contrasting condition classes. For each condition class recognized, several "ancillary attributes" that help describe the condition will be collected, but will not be used for mapping purposes (see Items 9+).

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within an annular plot (if applicable), subplot or *seedling/sapling* plot: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced, see *page 36*.

2. Indistinct boundary within a subplot: Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

   Example: The 4 subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large diameter trees. Subplot 2 falls in the middle of a stand size transition zone. In the zone, the large diameter stand phases into a sapling stand.

   Subplot 2 must not be divided into two mapped condition classes on the basis of stand size. Instead, it is treated entirely as part of the large diameter condition class or is assigned entirely to a new condition class that is classified as a seedling/sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedling/saplings than a stand of large diameter trees; then the boundary between the large and small diameter stands is assumed to occur between and not on the subplots.

3. A boundary or transition zone between fixed radii plots that sample distinctly different condition classes: Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed radius plots, but a distinct boundary or indistinct transition zone exists outside the sampled (fixed-radius) area of the subplots. In such cases, a boundary, if present, is not referenced.

   Example: The northernmost subplot (2) samples entirely accessible forest land. The other three subplots, 1, 3, and 4, fall clearly in a nonforest meadow. Between subplot 1 and 2 is a transition zone; the number of trees present goes from none to what clearly represents at least 10-percent tree stocking. Two condition classes are sampled: accessible forest land sampled on subplot 2, and nonforest land sampled on the other subplots.

Item 3--RESERVED STATUS

Record the code that identifies the reserved designation for the condition. Reserved land is withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood harvesting methods). Such authority is vested in a public agency or department, and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but rather is permanent in nature. The phrase

"withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products.

When collected: All accessible forestland condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors
Values:

Code	Reserve Status
0	Not reserved
1	Reserved

Item 4--OWNER GROUP

Record the OWNER GROUP code identifying the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will be mapped based on changes in OWNER GROUP only; separate conditions due to changes in OWNER GROUP are recognized only where differences can be clearly identified on the ground when visiting the plot.

When collected: All accessible forest land, condition classes (CONDITION STATUS = 1) and all Not In The Sample condition classes (CONDITION STATUS = 7)
Field width: 2 digit
MQO: No errors
Values:

Code	Owner Group
10	Forest Service
20	Other Federal
30	State and Local Government
40	Private

Item 5--FOREST TYPE

Record the code corresponding to the FOREST TYPE (*from Appendix* 4) that best describes the species with the plurality of stocking for all live trees in the condition class that are not overtopped.

The instructions *starting on page 47* apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST TYPE.

Examples:

* An area dominated by softwood tree species bordering an area dominated by hardwood species.

* A pure pine stand adjacent to a mixed conifer stand.

* A hardwood stand principally composed of dry site hardwood species that borders a stand dominated by wet site hardwood tree species.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 3 digits
MQO: No errors in group, 100% of the time; no errors in type, at least 95% of the time
Values: See Appendix 4 *on page 175*

Item 6--STAND SIZE CLASS

Record the code that best describes the predominant size class of all live trees in the condition class that are not overtopped.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors

Values:

Code	Stand Size Class	Definition
0	Nonstocked	Meeting the definition of accessible forest land, and one of the following applies: (a) less than 10 percent stocked by trees of any size, and not classified as chaparral, or (b) for forest types where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.
1	< 5.0 in. (seedling, sapling)	At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees less than 5.0 in d.b.h.
2	5.0 - 8.9 in (softwoods) 5.0 - 10.9 in (hardwoods)	At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in d.b.h. **and** the plurality of the crown cover is in softwoods between 5.0 - 8.9 in diameter and/or hardwoods between 5.0 - 10.9 in d.b.h., and/or western woodland trees 5.0 - 8.9 in d.r.c.
3	9.0 - 19.9 in (softwoods) 11.0 - 19.9 in (hardwoods)	At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in d.b.h. **and** the plurality of the crown cover is in softwoods between 9.0 - 19.9 in diameter and/or hardwoods between 11.0 - 19.9 in d.b.h., and for western woodland trees 9.0 - 19.9 in d.r.c.
4	20.0 - 39.9 in	At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in d.b.h. **and** the plurality of the crown cover is in trees between 20.0 - 39.9 in d.b.h.
5	40.0 + in	At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in d.b.h. **and** the plurality of the crown cover is in trees > 40.0 in d.b.h.
6	Chaparral	Less than 10 percent stocking by trees of any size, and greater than 5 percent **crown cover** of species that comprise chaparral communities

The instructions *starting on page 47* apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

Within the sampled area on *a seedling/sapling* plot or subplot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. Use tree stocking of all live trees that are not overtopped to differentiate between stand-size classes; for most western woodland forest types (e.g., pinyon, juniper, gambel oak) where stocking values are not readily available, use percent tree cover to represent stocking.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5% of the crown cover in STAND SIZE CLASSES of 1,2,3,4, and 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is either 0 or 6 depending on the characteristics of the stand. If at least 1/3 of crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), the accessible forested condition will be classified in one of these STAND SIZE CLASSES based on which of these STAND SIZE CLASSES has the most crown cover. If less than 1/3 of the crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), classify the accessible forested condition as a STAND SIZE CLASS = 1, if adequate cover is present.

If no other condition class defining variables are different between accessible forest conditions, map on differences in STAND SIZE CLASS only for the following combinations:

STAND SIZE CLASS	STAND SIZE CLASS
0 (Nonstocked)	1, 2, 3, 4, 5 (stocked forest land)
1	3, 4, 5
2	4, 5
3	5
6 (Chaparral)	1, 2, 3, 4, 5 (stocked forest land)

Item 7--REGENERATION STATUS

Record the code that best describes the degree of evidence of artificial regeneration which occurred in the condition.

The instructions *starting on page 47* apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

For a forest land condition to be delineated and/or classified as artificially regenerated, the condition must show distinct evidence of planting or seeding. If it is difficult to determine whether or not a stand has been planted or seeded, then use code 0. If no distinct boundary exists within the sampled (fixed-radius) area on any subplot, then do not recognize separate conditions. In many regions of the West, trees are not planted in rows, and planted stands do not differ in physical appearance from natural conditions. In these cases, there is no need to differentiate conditions based on stand origin.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors
Values:

Code	Artificial Regeneration	Description
0	Natural	Present stand shows no clear evidence of artificial regeneration. Includes unplanted, recently cut lands.
1	Artificial	Present stand shows clear evidence of artificial regeneration.

Item 8--TREE DENSITY

Record a code to indicate the relative tree density classification. Base the classification on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions *starting on page 47* apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate mapped condition classes are homogenous, i.e. when a change in density is the ONLY difference within what would otherwise be treated only as one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy but not total tree mortality due to a ground fire. Mapping on density should only be done when the less-dense condition is 50% or less as dense as the denser condition.

Do not distinguish between low stocked stands or stands of sparse and patchy forest.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors

Values:

Code	Tree Density
1	Initial density class
2	Density class 2 - density different than 1
3	Density class 3 - density different than 1 and 2

In order to qualify as a separate condition based on density, there MUST be a distinct, easily observed change in the density of an area's tree cover or basal area.

Examples of valid contrasting conditions defined by differences in tree density are forest land conditions with the same type, origin, stand size, ownership, and reserved status, but:

- the eastern half of an otherwise homogeneous, 20 ac stand has many trees killed by a bark beetle outbreak,

or

- one portion of a stand is partially cut over (with 40 sq. ft basal area per ac) while the other portion is undisturbed (with 100 sq. ft basal area per ac).

NON-MAPPING (ANCILLARY) VARIABLES for accessible forest land

Item 9--OWNER CLASS

Record the OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will **NOT** be mapped based on changes in owner class. If multiple owner classes within a *OWNER GROUP (see Item 4 on page 55)* occur on a single condition class, record the owner class closest to the plot center.

Owner class is downloaded/printed for condition class 1, and indicates the owner classification collected in the county courthouse for subplot 1 center (the pinpricked field grid location). Update this code for condition class 1 if incorrect.

If the owner group is updated for condition class 1, enter "YES" in "DOES CURRENT OWNER GROUP DIFFER FROM DOWNLOADED OWNER GROUP?" on the Plot Record and note the source of information. Oc3 owner class is found on the Oc3 plot card. If the difference is due to a real change in ownership since Oc3, record the date of the ownership change, if known, in "IF YES, DATE OF CHANGE" on the Plot Record.

A change in owner does not necessarily mean that owner class changed. For example, if Tubafore Lumber Co. was the owner at Oc3 but sold the site to Big Stick Wood Products, the owner class remained private.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land, and all Not In The Sample condition classes (CONDITION STATUS = 7)
Field width: *3 digits*
MQO: No errors
Values:

Owner Classes within Forest Service lands (Owner Group 10):

603 *Gifford Pinchot NF*
605 *Mt. Baker Snoqualmie NF*
608 *Okanogan NF*
609 *Olympic NF*
11 National Forest *other than the above*
12 National Grassland
13 Other Forest Service

Owner Classes within Other Federal lands (Owner Group 20)
21 National Park Service

22 Bureau of Land Management
23 Fish and Wildlife Service
24 Departments of Defense/Energy
25 Other Federal

Owner Classes within State and Local Government lands (Owner Group 30)
31 State
32 Local (County, Municipality, etc.)
33 Other Non Federal Public

Owner Classes within Private lands (Owner Group 40)
41 Corporate
42 Non Governmental Conservation / Natural Resources Organization - examples: Nature Conservancy, National Trust for Private Lands, Pacific Forest Trust, Boy Scouts of America, etc.
43 Unincorporated Partnerships / Associations / Clubs – examples: Hunting Clubs that **own, not lease** property, recreation associations, 4H, etc.
44 Native American (Indian) *other than the following:*

805	*Chehalis*	*817*	*Quinalt*
806	*Hoh*	*818*	*Shoalwater*
807	*Lummi*	*819*	*Skagit*
808	*Makah*	*820*	*Skokomish*
809	*Muckleshoot*	*821*	*Squaxin Island*
810	*Nisqually*	*822*	*Swinomish*
811	*Nooksack*	*823*	*Talalip*
812	*Saul-Suiattle*	*826*	*Lower Elwa*
813	*Port Gamble*	*830*	*Snohomish*
814	*Port Madison*	*831*	*Upper Skagit*
815	*Puyallup*	*832*	*Stillaguamish*
816	*Quileute*	*898*	*Suguamish*

45 Individual

Item 10--PRIVATE OWNER INDUSTRIAL STATUS

Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, “mom & pop” home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner’s industrial status due to name, commercial plant size, type plant, etc., choose code 0 below.

NOTE: Unit or State headquarters may have to maintain a list of recognized industrial owners within a State for crews to use when making these determinations.

When collected: *CONDITION CLASS NUMBER 1 when* accessible forest land *and* owner group *(Item 4)* is private (OWNER GROUP 40)
Field width: 1 digit
MQO: No errors
Values:

Code	Private Owner Industrial Status
0	Land **is not** owned by industrial owner with a wood processing plant
1	Land **is** owned by industrial owner with wood processing plant

Item 11--ARTIFICIAL REGENERATION SPECIES

Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand (*Item 7--REGENERATION STATUS on page 57 is coded "1"*). This

attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: *CONDITION CLASS NUMBER 1 when* accessible forest land with evidence of artificial regeneration (REGENERATION STATUS = 1)
Field width: 3 digits
MQO: No errors
Values: See *species list on page 99*

Item 12--STAND AGE

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for non-stocked stands.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for Site tree age, estimates of stand age should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

To estimate STAND AGE, select two or three dominant or codominant trees from the overstory. If the overstory covers a wide range of tree sizes and species, try to select the trees accordingly, but it is not necessary to core additional trees in such stands. The variance associated with mean stand age increases with stand heterogeneity, and additional cores are not likely to improve the estimate. Core each tree at the point of diameter measurement and count the rings between the outside edge and the core to the pith. Add in the number of years that passed from germination until the tree reached the point of core extraction to determine the total age of the tree. Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

$$(34 \times 0.25) + (62 \times 0.60) + (59 \times 0.15) = 55 \text{ years.}$$

In some cases, it may be possible to avoid coring trees to determine age. If a stand has not been seriously disturbed since the previous survey, simply add the number of years since the previous inventory to the previous STAND AGE. In other situations, cores collected from site trees can be used to estimate STAND AGE.

If a condition class is nonstocked, assign a STAND AGE of 000.

If all of the trees in a condition class are of a species which, by regional standards, can not be bored for age (e.g., mountain mahogany, tupelo) record 998. This code should be used in these cases only.

If tree cores are not counted in the field, but are collected and sent to the office for the counting of rings, record 999.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 3 digits
MQO: +/- 10%
Values: 000 to 997, 998, 999

General guide for converting BH age to total age for PNW species. Adjust as needed due to site variation and observed growth rates.

Species/location	Number of years to add to BH age

west side conifers	5
west side hardwoods	4
east side conifers	8
east side hardwoods	5

Item 13--DISTURBANCE 1

Record the code corresponding to the presence of the following disturbances. Disturbance can connote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 ac in size. Record up to three different disturbances per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

The disturbance codes below require "significant threshold" damage, which implies mortality and/or damage to 25 percent of individual trees in the condition class.

Record disturbances which have occurred since Oc3. On plots established at Oc3, record disturbances which occurred after the date of plot measurement. On plots visited for the first time at Oc4, use July, 1989 as the date of Oc3.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 2 digits
MQO: No errors
Values:

Code	Disturbance	Definition
00	none	No observable disturbance.
10	insects	
20	disease	
30	weather	Weather other than the following:
31	ice	
32	wind	Includes hurricane, tornado
33	flooding	Weather-induced
34	drought	
40	fire	Crown and ground fire, either prescribed or natural.
41	ground fire	
42	crown fire	
50	domestic animal or livestock	Includes grazing
60	wild animal	Wild animal other than the following:
61	beaver	includes flooding caused by beaver.
62	porcupine	
63	deer/ungulate	
64	bear	
65	rabbit	
70	human	Any significant threshold human-caused damage not described in the DISTURBANCE codes listed or *in* the TREATMENT codes listed below.
80	other natural	Any significant threshold natural damage, not described in the DISTURBANCE codes listed. *Describe the disturbance on the Plot Record sheet.*
81	Landslide	
82	Avalanche track	
83	Volcanic blast zone	
84	Other geologic event	

Item 14--DISTURBANCE YEAR 1

Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: When DISTURBANCE 1 > 00
Field width: 4 digits
MQO: No errors
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

Item 15--DISTURBANCE 2

If a stand has experienced more than one disturbance, record the second disturbance here. See DISTURBANCE 1 for coding instructions.

Item 16--DISTURBANCE YEAR 2

Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

Item 17--DISTURBANCE 3

If a stand has experienced more than two disturbances, record the third disturbance here. See DISTURBANCE 1 for coding instructions.

Item 18--DISTURBANCE YEAR 3

Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

Item 19--TREATMENT 1

Record the code corresponding to the presence of one of the following treatments since the last inventory cycle or within the past 5 years. The area affected by any treatment must be at least 1.0 ac in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

Record treatments which have occurred since Oc3. On plots established at Oc3, record treatments which occurred after the date of plot measurement. On plots visited for the first time at Oc4, use July, 1989 as the date of Oc3.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 2 digits
MQO: No errors
Values:

Code	Treatment	Description
00	None	No observable treatment.
10	Cutting	The removal of one or more trees from a stand.
11	Clearcut	Residual trees of all sizes have <25 percent crown cover. The residual trees usually are cull trees and low-value hardwoods. Not a firewood or local use harvest.
12	Partial cut (heavy) (≥20% removed)	Remaining trees comprise >25 percent crown cover and ≥20 percent of the trees live and 5.0 in. d.b.h. or larger were harvested. The residual stand usually consists of commercially desirable trees. Not a firewood or local use harvest.
13	Partial cut (light) (<20% removed)	Remaining trees comprise >25 percent crown cover and <20 percent of the trees live and 5.0 in. d.b.h. or larger were harvested. The residual stand usually consists of commercially desirable trees. Not a firewood or local use harvest.

14	firewood or local use cut	The harvest of trees for firewood, or the harvest of trees for products manufactured and used locally by "do-it-yourselfers", often on the ownership of origin, for improvements such as buildings, bridges and fences.
15	Incidental cut	Includes 1) the haphazard, seemingly random harvest of occasional trees in an otherwise undisturbed stand, or 2) the harvest of one or more trees sampled or reconstructed as live at Oc3 in a harvest activity which occurred primarily in an adjacent unmapped condition class but slopped over a bit into a mapped condition, or 3) any harvest activity that does not qualify as another kind of disturbance.
16	Precommercial thin	An intermediate harvest in which excess growing stock are cut but not removed.
17	Improvement cut	Cutting of commercial-sized, unsalable trees to free crop trees from competition. Improvement cutting differs from a commercial thinning in that the trees cut are not marketable.
20	Site preparation	Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	Artificial regeneration	Planting or direct seeding has resulted in a stand at least 50% stocked with live trees of any size.
31	Planting through-out the stand	Planting the area to establish a manageable stand.
32	Planting within nonstocked holes in the stand	Planting of nonstocked openings to fill-in or create a manageable stand.
33	Underplanting	Planting under a sawtimber overstory.
40	Natural regeneration	Growth of existing trees and/or natural seeding has resulted in a stand at least 50% stocked with live trees of any size.
50	Other silvicultural treatment	The use of fertilizers, herbicides, girdling, pruning or other activities (not already listed above) designed to improve the commercial value of the residual stand.
51	Stand conversion	Killing of low-value or unmarketable trees-often hardwoods-and planting of the area to establish a manageable stand. Most commonly, low-value hardwood stands are converted to conifer stands.
52	Clean and release	Killing or suppression of undesirable, competing vegetation-usually brush or hardwoods-from a manageable stand. A herbicide treatment in young, regenerated stands is one method of clean and release.
60	Chaining	Removal or killing of undesired woody species, not a silvicultural treatment.

Item 20--TREATMENT YEAR 1

Record the year in which TREATMENT 1 occurred.

When collected: When TREATMENT 1 > 00
Field width: 4 digits
MQO: No errors
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

Item 21--TREATMENT 2

If a stand has experienced more than one treatment, record the second treatment here. See TREATMENT 1 for coding instructions, code 00 if none.

Item 22--TREATMENT YEAR 2

Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.

Item 23--TREATMENT 3

If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions, code 00 if none.

Item 24--TREATMENT YEAR 3

Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.

Item 25--Condition class aspect

Record a 3-digit azimuth indicating the direction of slope for the land surface of the condition class. Use the aspects recorded by subplot as one aid to determine aspect by condition class. If the aspect is equally SE, S, SW, code the azimuth of the S aspect. If the aspect is SE, S, SW, but 80 percent of the condition class is SE; code the azimuth of the SE aspect. A 2-character code is downloaded/printed into condition class 1 if recorded in a previous inventory. Update this code with a 3-digit azimuth.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 3 digits
MQO: +/- 20 degrees
Values: See codes for SUBPLOT ASPECT on page 33

Item 26--Condition class percent slope

Record a 3-digit code indicating the average slope percent of the condition class. Use the slope percentages recorded by subplot as one aid to determine slope by condition class average. Printed/downloaded into condition class 1 if recorded in a previous inventory, update or correct as needed.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 3 digits
MQO: +/- 20%
Values: 000 to 155

Item 27--CONDITION CLASS PHYSIOGRAPHIC CLASS

Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition; land form, topographic position, and soil generally determine physiographic class. As a rule of thumb, look over the annular plot area to determine physiographic class, but always use your best judgment when assessing any condition level variables. *Apply the same coding system used for Subplot PHSIOGRAPHIC CLASS.*

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 2 digits
MQO: No errors
Values: see Subplot PHYSIOGRAPHIC CLASS on page 34

Item 28--Soil depth

1-digit code downloaded/printed for condition class 1 if recorded in a previous inventory. This item describes soil depth within each forest land condition class. Required for all forest condition classes. Code this item "1" when more than half of area in the condition class is estimated to be less than 20 in. deep.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land

Field width: 1 digit
MQO: No errors
Values:

Code	Definition
1	<20 in
2	≥20 in

Item 29--Stand condition

A 1-digit code that describes the condition of the stand within forest condition classes. Stand condition is defined here as "the size, density, and species composition of a plant community following disturbance and at various time intervals after disturbance." Information on stand condition is used in describing wildlife habitat.
The code is downloaded/printed for condition class 1 if recorded at Oc3. Update this downloaded/printed code if obviously incorrect.

When collected: *CONDITION CLASS NUMBER 1 when it is* accessible forest land
Field width: 1 digit
MQO: No errors
Values:

Code	Stand Condition	Definition
0	Not applicable	Condition class is juniper, chaparral, or curlleaf mountain mahogany forest type.
1	Grass-forb	Shrubs less than 40% crown cover and less than 5 feet tall; plot may range from being largely devoid of vegetation to dominance by herbaceous species (grasses and forbs); tree regeneration generally less than 5 feet tall and 40% cover.
2	Shrub	Shrubs 40% crown canopy or greater, of any height; trees less than 40% crown canopy and less than 1.0 in. d.b.h. When average stand diameter exceeds 1.0 in. d.b.h., plot is "open sapling" or "closed sapling."
3	Open sapling-poletimber	Average stand diameter 1.0-8.9 in. d.b.h., and tree crown canopy poletimber is less than 60%.
4	Closed sapling, pole, sawtimber	Average stand diameter is 1.0-21.0 in. d.b.h. and crown cover is 60% or greater.
5	Open sawtimber	Average stand diameter is 9.0-21.0 in. d.b.h., and crown cover is less than 60%.
6	Large sawtimber	Average stand diameter exceeds 21.0 in. d.b.h.; crown cover may be less than 100%; decay and decadence required for old-growth characteristics is generally lacking, successional trees required by old-growth may be lacking, and dead and down material required by old-growth is lacking.
7	Old-growth	Average stand diameter exceeds 21.0 in. d.b.h. Stands over 200 years old with at least two tree layers (overstory and understory), decay in living trees, snags, and down woody material. Some of the overstory layer may be composed of long-lived successional species (i.e. Douglas-fir, western redcedar).

Item 30--Plant Association

A 6-digit code that describes the predominant plant association of the site. The first 2 digits describe the climax overstory species, the species that is generally found in the reproduction, the third and fourth digits are the series, the last two digits are not used at this inventory. The code is downloaded/printed for condition class 1 if recorded at Oc3. Do not change this code.

Code	Plant Community Association

CA	Sub-alpine fir, mountain hemlock, whitebark pine (open forest)
CC	Western redcedar
CD	Douglas-fir
CE	Sub-alpine fir, Englemann spruce (closed forest)
CF	Silver fir, noble fir
CH	Western hemlock
CJ	Juniper, pinyon pine
CL	Lodge pole pine (climax or seral)
CM	Mountain hemlock
CP	Ponderosa, Jeffrey pine
CW	White fir, grand fir
CX	Coniferous forest
HX	Hardwood forest
HA	Alder
HB	Bigleaf maple
HC	Cottonwood, ash bottomland, overflow bottomland
HO	Oregon white oak
HQ	Quaking Aspen

Mapping (condition class defining) variables for nonforest land conditions:

Determining condition classes <u>within nonforest land</u>:

Nonforest land (Condition Status = 2) is subdivided into condition classes that are based on differences in the following nonforest land uses:

Item 31--PRESENT NONFOREST LAND USE

Record the Present Nonforest Land Use for all nonforest conditions (Condition Status 2), regardless of past condition. Use the codes and classifications listed below.

On all visited plots, map all nonforest condition classes present on the 55.8-foot fixed-radius at each ## subplot. Do not combine nonforest condition classes present. Example: if nonforest--urban land and nonforest--cropland are both present within a 55.8-foot fixed-radius plot, map each land class as a separate condition class.

When collected: *All nonforest land condition classes (CONDITION STATUS = 2)*
Field width: 2 digits
MQO: No errors
Values:

Code	Present nonforest land use	Definition
10	Agricultural land	Land managed for crops, pasture, or other agricultural use; the area must be at least 1.0 ac in size and 120.0 ft. wide. Use code 10 only for cases not better described by one of the following
11	Cropland	
12	Pasture	Improved through cultural practices
13	Idle farmland	
14	Orchard	
15	Christmas tree plantation	
20	Rangeland	Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 ac in size and 120.0 ft. wide
30	Developed	Land used primarily by humans for purposes other than forestry or agriculture. Use the code 30 only for land not better

		described by one of the following:
31	Cultural *or Urban*	Business, residential, and other places of intense human activity
32	Rights-of-way	Improved roads, railway, power lines, maintained canal
33	Recreation	Parks, skiing, golf courses
40	Other	Land parcels greater than 1.0 ac. in size and greater than 120.0 ft. wide, that do not fall into one of the uses described above *or below*. Examples include marshes, bogs. *Use the code 40 only for land not better described by the following:*
41	Naturally nonvegetated	Barren rock, sand, lava, glaciers

Procedures and variables for access denied plots:
Two additional variables are collected, in some cases, on plots for which access is denied. See the related instructions for Denied Access CONDITION STATUS on page 52.

1. If access is denied to the field grid location (center of subplot 1):
   A. if the plot was measured at Oc3 and was forest or other-forest and is still forest land at Oc4:
      For subplot 1 complete SUBPLOT CENTER CONDITION = 1,
      and CONDITION STATUS = 5.
      Complete Condition Class Attribute Item 32--Crown Closure at Oc3,
      and Item 33--Crown Closure at Oc4.
      No replacement plot is selected.

   B. If the plot was not measured at Oc3:
      Return the plot to the field supervisor.
      No replacement plot is selected.

2. If the field grid location is accessible but access is denied to a portion of, or an entire, Oc3 subplot :
   Complete the accessible portion of the plot following normal field procedures.
      No measurements are made on areas to which access is denied.
      See the related instructions for Denied Access CONDITION STATUS on page 52.
      If available, measure a total of 3 subplots qualify that as ## subplots.

Item 32--Crown Closure at Oc3
A 2-digit code required on Oc3 forest plots 1) to which access is denied at Oc4 and 2) on which harvest occurred since Oc3. If harvest occurred, record the percentage of overstory tree cover present at Oc3 within the Oc3 plot area. Record to the nearest 5 percent. If harvest occurred, record for the entire plot and not by condition class. If coded, Item 33--Crown Closure at Oc4 also requires an entry. See the preceding instructions, and CONDITION STATUS 5, Denied Access, on page 67.

Harvest is detected by comparing Oc3 and Oc4 photographs or by relying on-the-ground assessment from an accessible view point. If harvest occurred, interpret the percentage of Oc3 cover within Oc3 plot area using the Oc3 photographs.

Field width: 2 digits
MQO: +/- 15%
Values: 0 to 95

Item 33--Crown Closure at Oc4
A 2-digit code required on Oc3 forest plots 1) to which access is denied at Oc4 and 2) on which harvest occurred since Oc3. If harvest occurred, record the percentage of overstory tree cover present at Oc4 within the Oc3 plot area. Record to the nearest 5 percent. See the preceding instructions, and CONDITION STATUS 5, Denied Access, on page 67.

Harvest is detected by comparing Oc3 and Oc4 photographs or by relying on-the-ground assessment from an accessible view point. If harvest occurred, interpret the percentage of Oc4 cover within Oc3

plot area after harvest by 1) comparing Oc3 and 4 photographs if the harvest occurred before the date of the Oc4 photos or 2) by on-the-ground estimation if feasible and it is clear that the harvest occurred after the date of the Oc4 photos.

Field width: 2 digits
MQO: +/- 15%
Values: 0 to 95

VII. SITE INDEX

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VII. SITE INDEX

A. Introduction

Site index, a simple numerical value based upon tree height at a specified age, is commonly used to evaluate the potential productivity of tree growth on a forest site. On sites where soil moisture is adequate and soils are not toxic to tree growth, site index correlates well with the maximum potential stand volume and number of trees a site can attain at stand maturity. However, on sites with droughty or toxic soils, or otherwise unsuitable conditions, these maximums are reduced to levels lower than would otherwise be expected. On these impaired sites, site index alone does not correlate well with potential productivity.

On these sites, a estimate of stand density index (SDI) is required to assess productivity adequately; stand density index is the maximum number of trees per acre a site will support when stand d.b.h. is 10 inches (Reineke's stand density index) relative to the maximum expected number if the site were not impaired. An estimate of SDI for an impaired site can be compared with the stand density index expected on a similar, but unimpaired site to determine by how much to reduce estimates of potential productivity; the proportion of these two stand density indices is used to discount maximum potential stand density and tree growth (mean annual increment at culmination in a normal, fully stocked stand (MAI)).

SDI on a given site correlates well with the presence of specific combinations of key plant species, plant communities, and abiotic attributes. This information is collected as a part of the plant association data recorded in the condition class attributes chapter on (page 65). The plant association will allow us to estimate the maximum potential SDI possible on a condition class. We will use this estimate to determine to what extent, if any, the potential productivity (MAI) estimated using the condition class's site index should be discounted.

B. Site trees

General instructions

Select at least 1 site tree for each accessible forest land condition class *(see below)*; select tree from a species common to the condition class being sampled, based on regional or local tree species selection criteria.

An individual site tree may be used for more than one condition class where differences in conditions are not the result of differences in site productivity. For example, when different conditions are caused solely due to differences in reserve status, owner class, and/or disturbance-related differences in density (e.g., thinned vs. unthinned), a site tree may be used for more than one condition. When in doubt, do not use a site tree for more than one condition.

PNW-FIA requires at least 3, and sometimes 5 or 10 site trees per accessible forest land condition (though not all of the site trees need to be from the current inventory). Additional data beyond the national minimum described above will be collected at Oc4 in some cases.

At previous inventories, site tree data was collected at the plot level and will usually correspond to the current condition class 1. Collect additional site trees for this condition class if instructed to do so on the plot review sheet. In general, the reviewer has called for additional site tree data when site index information is incomplete, absent, or unreliable.

If there are no obvious differences in site productivity between condition classes, these trees can be used for other forest land condition classes on the plot.

If differences in site productivity do exist among conditions classes, use the previously collected site trees and/or additional site trees from the current inventory, to meet the site tree requirements for each condition class.

Previously visited plots

On many plots visited previously, the reviewer will recommend that no additional site trees are needed beyond the one tree per condition class required by national FIA procedures. For these plots, no other action is required on site trees unless the crew feels that the plot-level site index listed on the Oc3 plot card is not realistic. If this occurs, the crew should collect, if available, additional site trees that support their claim and should document their case in "Present Condition/Past Disturbance" on the PLOT RECORD.

On previously visited plots needing additional site trees, the reviewer has recommended what the crew needs to attempt. For these plots, the reviewer edited the site tree data collected during past inventories, and the trees that passed review are downloaded/printed. The crew should recommend if these trees should be dropped as site trees because they are not representative of forest land within the condition class area; do this by writing comments in Present condition/Past disturbance" on the PLOT RECORD. Do not delete or change downloaded site tree records, to update one of these trees, enter a new record.

If condition classes on the plot appear to have a different site productivity, collect a set of 3, 5 or 10 site trees for each condition using the site tree selection procedures below.

C. Selecting site trees

General instructions

1. An accessible forest land condition should have at least three representative site trees (and 5 or 10 if using King's method). If no suitable site trees are available from the condition class area, select trees from a nearby area with the same general aspect and elevation. If three trees still can not be obtained, get as many as possible and explain in "Present Condition/Past Disturbance" on the PLOT RECORD.

2. If the condition class is a hardwood site select the dominant tree species for site trees. A hardwood site is timberland that is a wetland site incapable of growing a manageable conifer stand, i.e. cottonwood flats along streams, red alder stands on low, wet ground.

3. If the condition class is a conifer site select only conifer site trees. A conifer site is any timberland site not meeting the hardwood site definition above.

4. The site trees should be representative of forest land across the condition class area.

5. Tree species should be the same for all site trees on a condition. There are exceptions to this rule:
   a) Douglas-fir and grand fir trees can be combined (Douglas-fir is preferred), and
   b) noble fir and mountain hemlock trees can be combined (noble fir is preferred), and
   c) western hemlock and sitka spruce can be combined (western hemlock is preferred).

6. Douglas-fir is the preferred site species throughout the coastal Douglas fir type in western Washington. Douglas-fir site trees can be selected using either King's or McArdles' selection method. King's method should be used, if possible, on new plots. On revisited plots with downloaded Douglas-fir site trees, use the selection method previously used unless you obtain an entire new set of trees; check the downloaded trees to see which was used (the downloaded equation variable is either "K" (King) or "M" (McArdle). Douglas-fir site trees on a plot should be all selected using King's method or should be all selected using McArdle's method, and should not be a mix of the two methods. Very specific rules apply in selecting site trees when using King's method and equation; do not use King's method unless these rules can be satisfied; see "Selecting site trees: King's selection method" on the next page.

7. In the sitka spruce/western hemlock type, western hemlock is the preferred site species (i.e. select hemlock over sitka spruce).

8. In lodgepole pine stands, try to get lodgepole site trees.

9. Silver fir in older stands should be avoided if possible due to the likelihood of a history of suppression.

10. Do not use cedar.

11. Do not use trees less than 15 years old at breast height.

12. Site index should not vary by more than 30 between site trees unless the difference can be explained by actual site variation within the condition. If indices vary by more than 30, explain why in "Present Condition/Past Disturbance" on the PLOT RECORD.

King's selection method
King's method is the preferred selection method for 1) Douglas-fir and grand fir and 2) for western hemlock and sitka spruce (do not mix these two groups of species).

1. Within the area of the standard layout, locate an approximately circular area that is moderately or well-stocked by a group of 25 mainstand a) Douglas-fir and grand firs or b) western hemlock and sitka spruce trees (do not mix these two groups of species) and is representative of the site being sampled. A very rough rule of thumb: this approximately circular area should not have a "diameter" greater than 120 to 130 feet. When determining the 25 trees, count only trees with normally-formed tops (no trees with forked tops or top out); do not include understory trees that are both younger and shorter than the general crown canopy.

2. From the 25 trees in the clump, select the 5 with the largest d.b.h. as site trees (the "1/5 rule") if the average breast height age of trees in the clump is $\geq$30 years. If the average age is <30 years, go to step 4.

3. Any site tree with a clear history of suppression should be rejected, and the next largest tree selected IF it is suitable. However select a suppressed tree over a shorter, suppression-free tree of the same age.

4. Sometimes only very young trees are available. Although site trees under 30 years breast-high age are undesirable, select site trees between 15 and 30 years old (age at breast age) if no others are available. Select from a clump of 50 mainstand Douglas-fir and grand firs or western hemlock and sitka spruce trees (do not mix these two groups of species), taking 10 with largest d.b.h. as site trees. Include only trees with normally-formed tops (no trees with forked tops or top out); do not include understory trees that are both younger and shorter than the general crown canopy.

5. If there are no suitable site trees selected within the plot area, select trees from a nearby group on the same general aspect and elevation, and note that the site trees were obtained off the plot in "Present Condition/Past Disturbance" on the PLOT RECORD.

McArdle's selection method
Use McArdle's selection method to select Douglas-fir and grand fir or western hemlock and sitka spruce if King's method can't be used. Always use McArdle's method to select all other species.

1. Select dominant trees representative of the plot area.

2. Site trees should be evenly distributed across the condition class area if possible.

3. Select trees that are and have been free from suppression for their entire lives. A tree that has been suppressed will have closely-space annual growth rings on all or part of its' increment core. Be particularly careful when in residual stands from which the dominant trees have been harvested.

4. If it is necessary to use true fir site trees, be very sure that they are not released understory trees. Never select true fir trees under 50 years old (breast height age). Select a Pacific silver fir only as a last resort.

5. Select site trees that show no signs of top-out, such as crooks and forks, unless these trees are taller than normally-formed trees of the same d.b.h.

6. Trees greater than 50 years old are desirable, but younger trees may be selected if none are available. For ponderosa pine, trees 60 to 120 years old are most desirable, but younger trees may be used if needed.

7. Do not use trees younger than 15 years old at breast height.

Site tree selection MQO

MQO: Fits general rules and site tree model

D. Site tree data variables

For each site tree record all of the following items:

Item 1--Site tree number (#)

Record a code indicating the assigned number for each site tree record on a plot. Numbers will be assigned before fieldwork to downloaded/printed site trees. The data recorder will automatically assign a number to each new site tree at Oc4.

Item 2--SUBPLOT NUMBER (SUB PL)

Use the same procedures described on page 33. Record a 2-digit code indicating the number of the subplot on which a site tree is on or near. Subplot numbers for site trees previously collected will be downloaded/printed if on file.

Item 3--CONDITION CLASS LIST (CC)

List all CONDITION CLASSES that the site index data from this tree represent. Record for new site trees. Record for downloaded site trees, usually condition class 1.

Field width: 5 digits
MQO: No errors
Values: 1 to 56789

Item 4--Tree number (TRN)

A 3-digit code. If a site tree is a trackable tree at Oc4, and has a tree number tag, record the number. If a site tree is not a trackable tree at Oc4, but has a tree tag number from a previous inventory, record the number. Otherwise leave blank.

Field width: 3 digits
MQO: No errors
Values: Blank, 1 to 999

Item 5--Azimuth (AZ)

Use the same procedures described on page 100 Record an azimuth for new site trees. Azimuth is from the subplot center to the site tree. Record the azimuth even if the site tree is not within 55.8 feet of a subplot center.

Item 6--Species (SPC)

Use the same species codes described on page 99. Species is downloaded for site trees previously collected. Record for new site trees.

Item 7--Diameter (DBH)

Use the same procedures described *on page 102*. Diameter is downloaded for site trees previously collected. Record for new site trees.

Item 8--SITE TREE LENGTH (HT)

With a clinometer or other approved instrument, measure the total length of the site tree from the ground to the top of the tree. Record to the nearest 1.0 ft. SITE TREE LENGTH must be measured; no estimates are permitted on site trees.

Downloaded for site trees previously collected. If updating a downloaded site tree, measure the tree's current height and enter it on the new (second) record for the tree (be sure also to enter a current b.h. age on the new record).

Field width: 3 digits
MQO: +/- 10% of true length
Values: 001 to 999

Item 9--TREE AGE AT DIAMETER (BH AGE)

Record the tree age as determined by an increment sample. Bore the tree at the point of diameter measurement (d.b.h.) with an increment borer. Count the rings between the outside edge of the core and the pith. Do not add years to get total age.

Downloaded for site trees previously collected. If updating a downloaded site tree, determine the number of years elapsed since the tree was taken as a site tree, add this number to the downloaded age and enter the sum on the new (second) record for the tree (be sure also to measure and enter the current height on the new record).

Field width: 3 digits
MQO: +/- 5 years
Values: 001 to 999

Item 10--Site Index (SI)

Downloaded for site trees previously collected. If a downloaded tree is updated for b.h. age and height, the data recorder will recalculate the tree's index. On a new site tree, the data recorder will calculate site index after the tree's species, height, b.h. age, and site index equation number are entered. If recording on paper, the index will be determined after the plot is entered electronically.

Item 11--Site index equation number (EQ)

A 1-digit code that indicates the site index equation that is used to compute site index. The equation number is downloaded for site trees previously collected. For new site trees, the Husky data recorder will enter the appropriate equation number after entry of species, height, and b.h. age.

An exception: When entering a Douglas-fir or grand fir site tree the Husky data recorder will prompt for the selection method used. Select “King” if the tree was selected using King’s criteria, and “McArdle” if it was selected using McArdle’s criteria. Do not mix Douglas fir site trees selected by using King’s method with Douglas fir site trees selected by using McArdle’s method.

Equation number	Species	Literature reference
1	Douglas-fir and grand fir - (except in the silver fir zone) Western white pine	"Site index tables for Douglas-fir in the Pacific Northwest" Weyerhauser paper no. 8, 1966. James E. King
2	Douglas-fir (in the silver fir zone)	"Height growth and site index curves for Douglas-fir in high elevation forests of the Oregon-Washington Cascades" Forest Science 20:307-315. 1974. Curtis, Herman and DeMars.
3	Western hemlock	"Site index tables for western hemlock in the Pacific

	Sitka spruce	Northwest" Weyerhauser paper no. 17, 1978. Kenneth N. Wiley
4	Noble fir Pacific silver fir Subalpine fir Mountain hemlock	"Height growth and site index estimates for noble fir in high elevation forests of the Oregon-Washington Cascades." Research paper PNW-243. 1978. Curtis, Herman and DeMars.
5	Western larch	Research paper INT-75. 1970 James E. Brickell
6	Englemann spruce	"Site index curves for Englemann spruce in the northern and central Rocky Mountains" Research note INT-142. 1966. James E. Brickell
7	Ponderosa pine	"Height growth and site index curves for managed even-aged stands of ponderosa pine in the Pacific Northwest." Research paper PNW-232. 1978. Barrett.
8	Lodge pole pine	"Gross yield of central Oregon lodgepole pine" In; Proceedings-Management of lodgepole pine ecosystems symposium. 1975 Research paper PNW-232. 1978.Dahms.
9	Red alder	"Normal Yield Tables for Red Alder" Research paper PNW-36. 1960. Worthington, et. al.

Item 12--SITE TREE NOTES

Record notes pertaining to an individual site tree.

When collected: All site trees as necessary
Field width: alphanumeric character field
MQO: N/A
Values: English language words, phrase and numbers

E. Site trees: post-field review

Crew coordinators will review each plot which needed new or additional site trees. The coordinators will check site tree data is complete, satisfies site tree instructions and is written up as needed. Afterwards, the lead techniquer will review each plot for site trees and plot site index. Prior to the techniquer's review, no one should delete site trees that were downloaded or added at Oc4.

VIII. VEGETATION PROFILE

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VIII. VEGETATION PROFILE

Information on the abundance, structure, and species composition of understory plant communities has many uses. The data is used to evaluate wildlife habitat suitability, forage availability, grazing potential, species richness and abundance, fire hazard, abundance of non-timber forest products, and potential site productivity. Accurately representing the species present on a site and their change in abundance in response to forest development, disturbance, or management is therefore important to a wide variety of users.

A. General design instructions for vegetation profile plots

In the most recent inventory of western Washington in 1988-1990, vegetation plots were installed at timberland (Oc3 GLC 20) and other-forest (Oc3 GLC 41, 44, 46) subplot centers. For timberland plots, 10.8 foot radius vegetation plots were installed at the center of each of the five subplots. In other-forest lands, a single 17.0 meter (55.8 ft.) radius vegetation plot was installed.

At Oc4, the previously installed 10.8 ft. vegetation plots will be remeasured in some cases. Do not remeasure the 1-17.0 meter (55.8 ft.) radius vegetation plot installed in other-forest lands.

Measure the vegetation plot on a subplot if the subplot qualifies as a ## subplot using the subplot-numbering criteria on page 17, and a 10.8 foot fixed-radius vegetation profile plot was taken at Oc3.

Vegetation will be assessed over the entire vegetation plot, regardless of the presence of two or more condition classes or nonforest inclusions.

B. Species records

General procedures

Individual species records are entered or updated. Individual species by layer are recorded within four plant groups: trees, shrubs, forbs and grass. Species records entered at Oc3 are downloaded/printed. A species is recorded if cover is found in sufficient cover on one or more vegetation profile plots taken across the field plot. Cover includes the cover of plants with a stem outside of the microplot boundary with foliage that overhangs into the microplot. On each species record, species, layer, and the percentage cover of the species by vegetation plot is entered.

Valid percentage cover amounts are: 0, 1 (in some cases), 5, 10, 15, ..., 95, 99.

Tree seedlings and shrubs

On each 10.8 foot fixed-radius vegetation profile plot, enter or update a record for each shrub species by layer present in any amount and for each tree species with seedling (<1.0 in. d.b.h.) cover present. Trees and shrubs <3% cover are recorded as "01".

Forbs

On each 10.8 foot fixed-radius vegetation profile plot, enter or update a record for each forb species by layer present with cover ≥3%. If several forbs are present that individually have <3% cover but that collectively have ≥3% cover, lump them into one code and estimate record the combined cover. If a downloaded forb record with >0% cover at Oc3 is present but <3% at Oc4, record "01".

Grasses and "grass-like" plants

On each 10.8 foot fixed-radius vegetation profile plot, enter or update each a record for grass species. Separate any downloaded Oc3 "GRASS" code into perennial and annual codes. If a downloaded grass record with >0% cover at Oc3 is present but <3% at Oc4, record "01".

Perennial grasses

Perennial grasses are identified by species if present in any amount (same as shrubs and trees).

Annual grasses
Annual grasses are recorded individually if present with cover ≥3%, and lumped into one record if individually present at <3% but collectively cover ≥3% (same as forbs). **Except** for Bromus tectorum, which if present in any amount >0 is recorded separately (like a tree or shrub).

1. Species
Each species record must have a species code recorded in the "OC3 SPC" or the "OC4 SPC" column. Valid species codes are listed in the plant guide. If you cannot identify a species while in the field, collect a specimen for later identification (see page 85). If you cannot identify the species of the plant, record the code for its genus if possible. If not, record one of the following generic codes:

Unknown Species Code	Life-form	Lumped Species Code
SHRUB1	Shrubs	**---**
FORB1	Forbs	**FORBS**
GRASS1	Graminoid including sedges and rushes	**GRASS**
AAGG1	Annual grasses	**AAGGS**
PPGG1	Perennial grasses	**---**

If another species of the same life-form can not be identified, it is labeled with the life-form followed by the number 2 (SHRUB2, FORB2, etc.). Up to five unknowns of each life-form may be recorded.

A generic record by plant form and layer is entered when a group of forb species (forb or fern), or annual grass species, covers 3 or more percent on a vegetation plot but, as individual species, do not. Example: 6 species of forbs are present within a layer; one species covers 10 percent, and the other 5 species each cover 2 percent. Two records are entered: one record for the species of 10 percent, and a second generic FORBS record for the other 5 species which collectively cover 10 percent.

On a remeasured vegetation profile plot, it is not necessary to enter an Oc4 species if the printed/downloaded Oc3 species is correct. Oc4 layer, and subplot percent cover are entered on the same line.

- **If an Oc3 species was misidentified or needs to be changed:** record the updated species in the "OC4 SPC" column; never delete the downloaded/printed Oc3 species code.

- **Splitting/Lumping species:** If two or more species were lumped into one generic record at Oc3 and can be separated by species at Oc4, add a new record for each species. On the new records, complete by subplot the Oc3 as well as the Oc4 percent cover, and layer. For these new records, the sum of their Oc3 percent covers by subplot should be equal to or less than the Oc3 percent covers recorded at Oc3 on the generic record. If some of the species grouped into one record at Oc3 still can not be identified, adjust the Oc3 subplot percent cover on the generic record to include only these species and code layer and Oc4 subplot percent cover collectively for this group.

  If all species grouped at Oc3 can be identified and assigned separate records, record "00"s in the Oc4 column for Oc4 subplot percent covers on the old generic group record. Or, in the Oc4 column, record the percentages for each "split-out" species record, and record the remaining Oc4 percentages on the old generic record for those species that can not be identified individually.

- **Missed species:** If a species was obviously missed at Oc3, add a new line for it. Set Oc3 percent cover equal to Oc4 percent cover for a missed species.

- **New Species:** If a species was not recorded at Oc3, but presently exceeds the minimum cover requirement (present for trees, shrubs, or perennial grasses, or ≥3% for forbs and annual grasses), record a new record. Set Oc3 percent cover by vegetation plot to "00".

Species MQO: Tree, shrub, and perennial grass species recognized
Forb and annual grass species recognized

Is it a tree or is it a shrub?
Tally the following species as trees if they are, or will become, trees. A tree is defined as a woody plant that commonly has a perennial stem that is ≥3.0 in. d.b.h. at maturity and a total height at maturity of ≥12 ft

Common Name	Genus	Species	NRCS Abbreviation	Code
Cherry and Plum	Prunus	spp.	PRUNU, OR PREM, PRVI	760
Willow	Salix	spp.	SALIX	920
Pacific Dogwood	Cornus	nuttalli	CONU4	492
Cascara buckthorn	Frangula	purshiana	FRPU7	999
Curlleaf mountain mahogany	Cerocarpus	ledifolius	CELE3	475

Although the following species occasionally attain tree size, they are always considered shrubs and are not tallied as trees:

Common name	Genus	Species	Exceptions
Serviceberry	Amelanchier	spp.	
Ceanothus	Ceanothus	spp.	
Mountain mahogany	Cercocarpus	spp.	Cercocarpus ledifolius
Bog birch	Betula	pumila var. gland.	
Red or water birch	Betula	occidentalis	
Redbud	Cercis	orbiculata	
Bush chinquapin	Chrysolepis	spp.	
Silktassel tree	Garryna	spp.	
Ocean spray	Holodiscus	discolor	
Rhododendron	Rhododendron	spp.	
Hazel	Corylus	spp.	
Poison-oak	Toxicodendron	spp.	
Manzanita	Arctostaphylos	spp.	
Buckthorn	Frangula	spp.	Frangula purshiana
Vine maple	Acer	circinatum	
Mountain maple	Acer	glabrum	
Elderberry	Sambucus	spp.	
Douglas maple	Acer	glabrum douglasii	
Indian plum	Oemleria	cerasiformis	
Ninebark	Physocarpus	spp.	
Mountain ash	Sorbus	spp.	
Mockorange	Philadelphus	spp.	
Thinleaf alder	Alnus	incana ten.	
Creek and redstem dogwood	Cornus	spp.	Cornus nuttalli
Sitka alder	Alnus	sinuata	
Hawthorne	Crataegus	spp.	
Arrowwood	Viburnum	spp.	

2. Canopy layer
Record a 1-digit canopy layer code for each line entry. Downloaded/printed Oc3 records include the Oc3 layer entries. The code indicates the canopy layer by plant form to which a recorded species is assigned at Oc4. Canopy layer heights are assigned not by individual vegetation plot, but across the entire evaluated areas on all vegetation profile plots on a field plot (see page 83). A species can be in more than one layer by repeating the species code on an additional line.

MQO: Different canopy layers recognized

3. Vegetation plot percent cover

Record a 2-digit code for percent cover on each vegetation plot. A plant's stem can be outside evaluated area, but its crown may be partly within the area and included as part of percent cover for the species. Cover is recorded in increments of 5%. Code a "99" if the species covers the entire layer. Species previously recorded with cover >0% and currently not present on the vegetation plot are recorded as 0%. Enter new records for species not previously recorded that meet the minimum coverage percents. Tree, shrub, and perennial grass species that cover less than 3% are recorded as "01".

For forbs and annual grasses, if Oc3 vegetation plot percent cover on a downloaded record is greater than 0, and Oc4 cover is present but less than 3 percent, enter Oc4 vegetation plot percent cover as "01". If Oc3 vegetation plot percent cover on a downloaded forb or annual grass record is equal to 0, and Oc4 cover is present but less than 3 percent, enter Oc4 vegetation plot percent cover as "00".

General rules: For each species record, estimate percent cover as the portion of the fixed-radius plot that would be obscured by all plants of the species if viewed from directly above the fixed-radius plot. In estimating cover, include the entire area within the general outline of a plant; ignore minor gaps between branches, and holes in the center of the plant. Because of overlap, the sum of individual species within any one canopy layer can be greater than 100 percent.

Base the percent cover estimate for forbs and grasses on the current years' growth. Include both living and dead material from the current year.

Record the percent cover estimate made at the time of the Oc4 visit. Do not adjust the percent for the time of year during which the visit was made (i.e. the plants are immature and small because the plot is being completed early in the growing season).

Oc3 and Oc4 percent cover of shrubs, forbs and grass on reevaluated vegetation plots: For each shrub, forb and grass species recorded at Oc3, Oc3 vegetation plot percent cover has been printed/downloaded. Use this downloaded percent as a guide. Record the percent cover estimate made during the Oc4 visit.

MQO: Highest 5 cover species for each life form ranked in relative order

4. Stage of development for shrubs
For each shrub record with an Oc4 percentage of cover >0 on one or more vegetation plots, enter the code below that best describes the shrub's stage of development within evaluated area across all vegetation profile plots on a plot.

Code	Shrub Stage of Development
1	Immature, no dead material (stems and branches) associated with the shrub record.
2	Mature, 1-24 percent dead material associated with the shrub record.
3	Over-mature, 25 percent or more dead material associated with shrub record.

MQO: Different shrub stage of development classes recognized

C. Vegetation profile plot - total cover and layers

1. Percent cover of "all shrubs", "all forbs" and "all grass"
Record the total percent of cover of **all shrubs, all forbs,** and **all grass** within each vegetation profile plot sampled on the field plot. Record percent cover to the nearest 5 percent using a 2-digit code. Estimate percent cover as the portion of the fixed-radius vegetation plot that would be obscured by all shrub species/all forb species if viewed from directly above. Record total crown closure as "99". If "all shrubs", "all forbs" or "all grass" is greater than 0 but less than 3 percent cover, enter "01".

Total percent cover for a plant group (shrubs, forbs or grass) cannot exceed 100 percent. Total percent cover for a plant group cannot exceed the sum of percent cover recorded for all individual species (in both layers) of the plant group. However, total percent cover for a plant group can be, and often is, less than

the sum of cover for all individual species within the group. This happens because of overlap between layers or when several species with 3-percent cover are coded individually as 5-percent (or more) cover.

MQO: +/- 20%

2. Summary of canopy layer heights
Canopy layer heights are assigned to each plant group. This is done not by individual vegetation plot, but across the entire evaluated area on all of the vegetation profile plots on a field plot.

There can be 2 canopy layers for each plant group (tree seedlings, shrubs, forbs, and grass) on the vegetation plots. Record height of a canopy layer as a 2-digit code to the nearest foot for each layer within each plant group. Layer 1 is the taller layer within each plant group, and layer 2, the shorter layer. For instance, layer 1 height for shrubs would be the average height of the taller shrubs across the forest condition classes sampled for vegetation profile, and layer 2 height for shrubs would be the average height of shorter shrubs across the forest condition classes sampled for vegetation profile. If there is only one layer in the plant group, record the height in layer 1.

As work progresses on vegetation plots, adjust the heights of the layers to better represent average layer heights across all the evaluated area on all of the subplots.

Determine if there are one or more layers for a plant group sampled across the plot area.

Height guidelines for recognizing separate layers are:
- **Grass** canopy layers must differ by at least 2 feet.
- **Forb** canopy layers must differ by at least 2 feet.
- **Shrub** canopy layers must differ by at least 4 feet.
- **Tree seedling** layers must differ by at least 4 feet.

MQO: Grass and forbs: +/- 1.0 ft.
Shrubs and trees: +/- 3.0 ft.

3. Percent bare soil
Record the percent of the evaluated area that is covered by bare soil. Bare soil is mineral material that, viewed from above, is not over-topped by grass, forbs, shrubs, seedlings or saplings. It is also not covered by duff, litter, cowpies, woody debris, moss or other material. Sand, stones and bedrock are not considered bare soil. Record percent bare soil to the nearest 5 percent using a 2-digit code. If the vegetation plot is entirely bare soil, record as "99". Record "01" for bare soil greater than 0 but less than 3 percent. This data is used to help make estimates of erosion, range condition and disturbance. It therefore includes only areas of bare soil having no cover at all, or only the cover of crowns on trees $\geq$ 5.0 in. d.b.h.

MQO: +/- 20%

4. Percent total vegetation cover
Record the percent of the evaluated area that is covered by any of the components measured on the vegetation profile plot (tree seedlings, shrubs, forbs and grass). Estimate percent cover as the portion of the fixed-radius vegetation plot within the condition class being evaluated that would be obscured by seedling/shrub/forb/grass species if viewed from directly above. Ignore crown overlap. Record total vegetation cover as "99". Record "01" for total vegetation cover greater than 0 but less than 3 percent. Percent total vegetation cover and percent bare soil combined can not exceed 100 percent, and will likely be less due to the way each is defined and the inclusion of different elements.

MQO: +/- 20%

D. Percent cover calculations

Use the following calculations as a guide in determining cover percents.

radius (ft)	area (sq ft)		
10.8	**366.25**		
%	area (sq ft)	radius (ft)	square (ft)
1	3.66	1.08	1.91
3	10.99	1.87	3.31
5	18.31	2.41	4.28
10	36.62	3.42	6.05
15	54.94	4.18	7.41
20	73.25	4.83	8.56
25	91.56	5.40	9.57
50	183.12	7.64	13.53
75	274.69	9.35	16.57

E. SEEDLING COUNT

Stocking and regeneration information are obtained by counting seedlings within the *NE quadrant of the 10.8' radius seedling/sapling* plot. Conifer seedlings must be at least *0.5 ft.* in length and less than 1.0 in at d.b.h. in order to qualify for *counting*. Hardwood seedlings must be at least *1.0 ft.* in length and less than 1.0 in at d.b.h. in order to qualify for *counting*. Seedlings are counted in groups by species and condition class, up to 5 individuals per species. Counts beyond 5 are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. Only count seedlings occurring in accessible forest land condition classes *on established (##) subplots*.

Count all live seedlings regardless of vigor, damage, or closeness to other trees, but count only one seeding from a clump; a clump is 3 or more live stems that sprouted from a common root base (including stumps). Note: The selection criteria for seedling count differs from the selection criteria for seedlings on the trackable tree tally (page 93).

SEEDLING COUNT DATA ITEMS

Seedlings are counted within each accessible forest land condition class on each seedling/sapling plot. Record the following data items for each seedling count:

Item 1--SUBPLOT NUMBER

Use the procedures outlined on page 33

Item 2--CONDITION CLASS NUMBER

Use the procedures outlined on page 47

Item 3--Species

Use the procedures and codes outlined on page 99.

MQO: No errors for genus at least 90% of the time,
no errors for species at least 85% of the time
Values: See page 99.

Item 4--SEEDLING COUNT

Record the number of seedlings of each species, by condition class. Count up to 5 individuals by species; code 6 if there are more than 5 individuals of any given species in any given condition class. Code species in order from most abundant to least abundant when SEEDLING COUNT is coded as 6.

Field width: 1 digit
MQO: No errors

Values:		
	0	None
	1 to 5	Exact count
	6	More than 5 individuals by species by condition class

F. Collection and identification of unknown plants

To improve the quality of vegetation profile data, a formal procedure is followed to identify more of the unknown plant species that are tallied.

Each crew (truck) will be supplied with a three-ring binder containing sealable plastic bags for the collection of unidentified specimens. The binders provide some degree of protection to collected plants, and help to prevent their loss. Each bag has a label that should be filled out when a specimen is collected; the label identifies the plot and subplot from which the bagged specimen was collected.

While on the plot, the crew should not spend an inordinate amount of time trying to identify an unknown plant. If the plant can be keyed out quickly using a plant guide, identification should be attempted. If the crew is confident the plot can be completed in one day, they can spend more time trying to identify unknown plants while on the plot. In most cases, though, it will be more effective to collect unknown plants for later identification. If the plant can not be identified and qualifies for tally as a generic life-form record (shrub, forb, fern, grass), enter the record.

Gather as much of the complete plant as is feasible. Include roots, flowers, and seed-heads if possible. Write a brief description of the site from which the plant was collected, the plant community of which it was a member, and any other information which may assist in identification.

Once back at the motel, try to identify the collected specimens the same day that the plot was visited. Use whatever plant guides are available and the Polyclave program if available, on the laptop computer. Other field team members who might be familiar with the species and/or are good at plant identification may be consulted. Twenty minutes is the recommended maximum amount of time that should be spent on one plant. If the specimen can not be identified, contact the crew coordinator. If the same plant is collected several times and identification attempts are unsuccessful, the crew coordinator may contact a botanist for identification.

If no attempt can be made to key out a plant the same day it is collected, the specimen should be placed in a plant press (one is in each vehicle). Do not leave the specimen in the plastic bag; specimens left bagged may mildew and mold.
If a plant is successfully identified, the vegetation profile data for that plot should be updated before transferring the plot data to the laptop computer.

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IX. TRACKABLE TREE AND SNAG SELECTION

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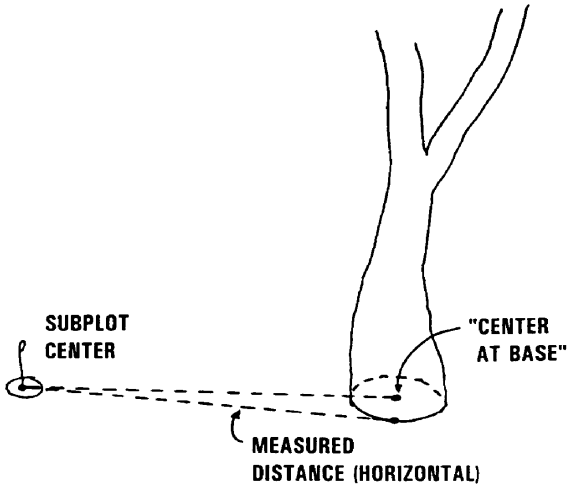
IX. TRACKABLE TREE AND SNAG SELECTION

A. Introduction
Large trees and snags (≥6.9 in. d.b.h.) are sampled using variable-radius sampling. The basal area factor used is 7 square meters per hectare (BAF 7). Trees and snags whose bole center at d.b.h. is more than 55.8 feet horizontal distance from subplot center are not sampled even if within their limiting distance ("in" with the BAF 7 prism; see page 165). This is done to avoid selecting trees that are too far from subplot center to influence growing conditions at subplot center and to sample large trees efficiently.

Mid-sized trees (5.0 in. to 6.8 in. d.b.h.) are sampled more efficiently using a small fixed-radius plot. The plot's fixed-radius, 10.8 feet is the limiting distance for a tree with a d.b.h. of 6.9 in. when trees are selected using variable-radius sampling with a BAF of 7 (metric).

Seedlings (conifers <1.0 in. d.b.h. and ≥0.5 ft. tall, and hardwoods <1.0 in. d.b.h. and ≥1.0 ft. tall) and saplings (trees 1.0 to 4.9 in. d.b.h.) are sampled more efficiently using a portion of the small fixed-radius plot. They are sampled within the NE quadrant of the 10.8 ft. fixed-radius plot.

B. Determining if a tree/sapling/seedling is selected on a fixed-radius plot
Trees are selected only when the distance from their bole center at the ground to the subplot center is less than the radius of that subplot/seedling sapling plot (see figure below).



C. Determining if a tree or snag >6.9 in. d.b.h. is sampled using variable-radius sampling
Limiting distance is the horizontal distance from subplot center to the bole center of a tree at d.b.h. that the tree must be within to be sampled. Limiting distances vary by diameter; as diameter increases; limiting distance increases. Limiting distances by diameter are listed for variable-radius sampling with a basal area factor of 7 M on page 165. The limiting distance for a tree may also be calculated using the following equation:

L = F x d.b.h. where: L = limiting distance in feet;
F = **1.57465** for 7 M BAF prism;
d.b.h. = the tree's diameter at breast height (d.b.h.) in inches

Usually, it is clear, when using a prism, whether or not a tree or snag >6.9 in. d.b.h. should be sampled; i.e., it is usually obvious if the tree or snag is within ("in") or beyond ('out') its limiting distance. However, some trees and snags are borderline: not clearly "in" or "out' when viewed through the prism.

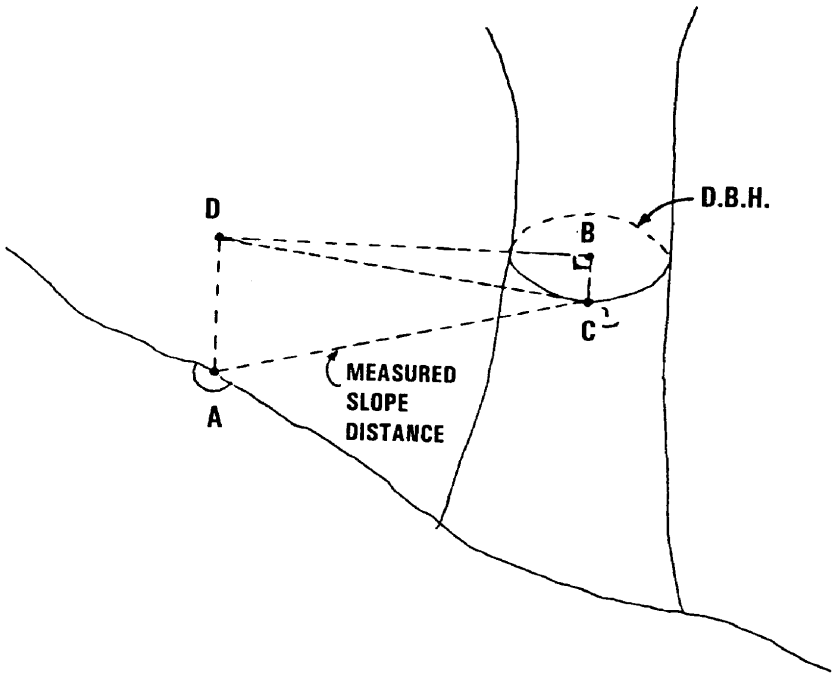
Use the following method to check borderline trees and snags:

1. Drive a nail into the tree at breast height (point C), at a location that is perpendicular to the sample point.

2. Use a measuring tape to determine the slope distance from the nail to subplot center (point C to point A).

3. Using a clinometer, measure the slope along this line (sighting from point C to point A). Use the slope correction table in on page 163 to calculate the actual horizontal distance from C to A; this distance equals the distance from B to D.

4. Compare this calculated horizontal distance to the limiting distance (page 165) for the tree's d.b.h. If the actual distance is less than the limiting distance, the tree is "in." If the actual distance is greater than the limiting distance, the tree is "out."



D. Trackable tree and snag selection
One of the following two alternatives applies:

1.) If the condition class has a Oc3 forest ground land class of 20 and is still accessible forest land, and the condition class requires remeasurement of trees and snags sampled at Oc3 (condition class is 1 on a ## subplot), do following steps in the condition class:

a) Account for each downloaded tree in condition class 1 that was tallied live and 1.0-4.9 in. d.b.h. at Oc3.

If the tree is still live, the tree keeps its tree history of 1.

If the tree has been culturally-killed or harvested, assign a tree history of 3. If still standing and >5.0 in. d.b.h. and >4.5 feet tall and has a bole which does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line number as the culturally-killed tree record. Snag use is 10 or 11. See page 98 for the definitions of "culturally-killed tree" and "harvested tree."

If the tree died of natural causes, assign a tree history of 5. If still standing and >5.0 in. d.b.h. and >4.5 feet tall and has a bole which does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line

number as the mortality tree record. Snag use is 10 or 11. See page 98 for the definition of "dead (mortality) tree."

b) Tally, if within the NE quadrant of the 10.8-foot fixed-radius plot, any live tree 1.0-4.9 in. d.b.h. in condition class 1 that was not tallied at Oc3. The tree at Oc3 was either not yet alive, a seedling, or a missed tree. (A missed tree is a live tree which should have been selected at Oc3 but was not).

If the tree was not alive or was a seedling at Oc3, assign a tree history of 4.

If the tree was missed at Oc3, assign a tree history of 6.

c) Account for each downloaded tree in condition class 1 that was tallied live and 5.0-6.8 in. d.b.h. at Oc3.

If the tree is still live, the tree keeps its tree history of 1.

If the tree has been culturally-killed, assign a tree history of 3. If still standing and ≥5.0 in. d.b.h. and ≥4.5 feet tall and has a bole which does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line number as the culturally-killed tree record. Snag use is 10 or 11. See page 98 for the definitions of "culturally-killed tree."

If the tree died of natural causes, assign a tree history of 5. If still standing and ≥5.0 in. d.b.h. and ≥4.5 feet tall and has a bole which does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line number as the mortality tree record. Snag use is 10 or 11. See page 98 for the definition of "dead (mortality) tree."

d) Tally, if anywhere within the 10.8-foot fixed-radius plot, any live tree 5.0-6.8 in. d.b.h. in condition class 1 that was not tallied at Oc3. The tree at Oc3 was either not yet alive, a seedling, or a missed tree. (A missed tree is a live tree which should have been selected at Oc3 but was not).

If the tree was not alive or was a seedling at Oc3, assign a tree history of 4.

If the tree was missed at Oc3, assign a tree history of 6.

e) Account for each downloaded tree in condition class 1 that was tallied live and >6.9 in. d.b.h. at Oc3.

If the tree is still live, the tree keeps its tree history of 1.

If culturally-killed, assign the tree a tree history of 3. If still standing and >5.0 in. d.b.h. and >4.5 feet tall and with a bole that does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line number as the culturally-killed tree record. See page 98 for the definition of a culturally-killed tree.

If dead of natural causes, assign the tree a tree history of 5. If still standing and >5.0 in. d.b.h., and >4.5 feet tall, and with a bole that does not touch the ground, also enter the tree as a snag with a tree history of 7 on a new line that is assigned the same line number as the dead tree record. See page 98 for the definition of a dead (mortality) tree.

If harvested, assign the tree a tree history of 8. See page 98 for the definition of a harvested tree.

If the horizontal distance from the subplot center to the bole center of the tree at d.b.h. is greater than 55.8 feet, assign a tree history of "X" and include an explanation in the tree remarks section.

f) Tally any live tree >6.9 in. d.b.h. in condition class 1 that was not tallied at Oc3, but is "in" using a 7 M BAF prism and is, at bole center at d.b.h., within 55.8 ft. horizontal distance of the subplot center.

Note: on Oc3 "walk-through" plots (see Item 17--Oc3 plot type on page 26) ingrowth prism trees were not tallied at Oc3. Use the calculated Oc3 d.b.h. and horizontal distance from the subplot center to the center of the tree at d.b.h. to determine if the tree has a tree history of 2 or 6 at Oc4 (i.e. if it was “in” or not at the time of Oc3 inventory).

Assign a tree history of 2 if the tree was >1.0 in. d.b.h. at Oc3 but was too small to be selected at Oc3.

Assign a tree history of 4 if the tree was <1.0 in. d.b.h. at Oc3 and is within the NE quadrant of the 10.8-foot fixed-radius plot.

Assign a tree history of 6 if the tree was >6.9 in. d.b.h. and "in" at Oc3 but missed (or not tallied on a walk-through plot) at Oc3.

g) Tally live seedlings (a conifer <1.0 in. d.b.h. and ≥0.5 ft. tall, or a hardwood <1.0 in. d.b.h. and ≥1.0 ft. tall) present within the NE quadrant of the 10.8-foot fixed-radius plot if the combined tally of live trees >1.0 in. d.b.h. present in condition class 1 on the subplot is less than **3**. Tally seedlings, if present, until the total tally of live trees is 3 in condition class 1 on the subplot. Assign these seedlings tree histories of 4. Tally a seedling only if it meets the requirements specified in the section "Seedling requirements" on page 93.

h) Account for each downloaded snag in condition class 1 that was tallied as a snag at Oc3. An Oc3 snag is either 1) a snag that is still >5.0 in. d.b.h., and >4.5 feet tall, and with a bole that does not touch the ground, 2) a snag that is still present but no longer meets one or more of these minimum specifications, or 3) a snag now down or gone. Tree history is a 7 in each of these cases but data requirements differ by case; refer to the appropriate tally guide record. A snag tallied at Oc3 that is still >5.0 in. d.b.h. but no longer "in" with a 7 M BAF prism at Oc4 is still "in."

i) Tally any snag in condition class 1 that was missed but "in" with a 7 M BAF prism at Oc3. To qualify, a snag has to have been a snag >5.0 in. d.b.h., >4.5 feet tall at Oc3, and must meet these minimum diameter and height specifications at Oc4. Additionally at Oc4, the snag must have a bole which does not touch the ground, and must still be "in" with a BAF 7 M prism and must be, at bole center at d.b.h., within 55.8-feet horizontal distance of the subplot center. Assign the snag a tree history of 7, set Oc3 d.b.h. equal to Oc4 d.b.h. and set Oc3 height equal to Oc4 height. The Husky assigns the snag record a new line number. At Oc3, only snags greater than 10.0 in. d.b.h. and snags greater than 6.6 feet tall were tallied. Snags >5.0 in. d.b.h. and <10.0 in. d.b.h. and snags >4.5 feet and <6.6 feet tall not tallied at Oc3, but meeting the above criteria, are tallied at Oc4 as "missed" with a tree history of 7.

j) Tally any snags in condition class 1 that have "grown in" since Oc3 and died. To qualify, the snag has to have been live at Oc3, but did not qualify for tally on the fixed or variable-radius plot (i.e. it was "out"). At Oc4 the snag must be "in" with a BAF 7 M prism, >5.0 in. d.b.h., >4.5 feet tall, and have a bole that does not touch the ground, and must be, at bole center at d.b.h., within 55.8 ft. horizontal distance of the subplot center. Assign the snag a tree history of 7, leave Oc3 d.b.h. and Oc3 height blank. Snag use is 10 or 11. The Husky assigns the snag record a new line number. No mortality record is needed.

2.) If at Oc4 the condition class is ≥2:

a) Account for each downloaded tree in condition class 2.

Tree is assigned a tree history of "x"

b) Do not tally any other trees in condition class 2.

E. Seedling requirements

A seedling is: a live tree less than 1.0 in. d.b.h., a conifer at least 0.5 ft. in height or a hardwood at least 1.0 ft. in height, and established in mineral soil. (The requirements that follow differ from the requirements for "Seedling Count" on page 84).

Tally a seedling only if it meets the following requirements:

1. Select a seedling only if its bole center at the ground is within the NE Quadrant of the seedling/sapling plot 10.8 feet (horizontal distance) of subplot center.

2. Select a seedling only if it is expected to live at least 10 more years.

3. Do not tally a suppressed seedling.

4. If a seedling is dominant or codominant and less than 4.5 feet tall, it must be at least 2 feet from any other tally tree. An intermediate or overtopped seedling of any height must be at least 2 feet from any other tally tree. Ignore residual overstory trees ≥5.0 in. d.b.h. when evaluating the crown class of an additional stocking seedling.

5. If a conifer, select a seedling only if it currently is not overtopped and shaded by another conifer and will not be overtopped and shaded by another conifer before reaching 9.0 in. d.b.h. This includes overtopping by other conifers that are within or outside the 6.8 foot fixed-radius plot. Ignore overtopping by conifers ≥9.0 in. d.b.h. and 50 years old (b.h. age) if the conifer seedling is of a shade tolerant species (true firs except noble fir, hemlocks, spruces, and cedars except incense cedar).

   Whether or not a conifer is overtopped is estimated by using the "inverted cone" method. This method projects two straight lines along the branch tips of a tree's cone-shaped crown upward from their intersection at the tree's tip to create an imaginary cone, in the growing space above the tree as shown in the figure below. If one-third or more of the imaginary cone is occupied by the live crown(s) of other conifer(s), the tree is considered overtopped. If less than one-third of the imaginary cone is occupied, the tree is considered "free-to-grow".

6. Only one hardwood seedling in a hardwood clump can be selected. If more than one seedling in a clump is a candidate for being tallied, select the most dominant seedling candidate. Do not tally seedling-sized suckers that have sprouted from the base of a live, unsuppressed hardwood stem that is ≥5.0 in. d.b.h. A clump is defined as 3 or more live stems that sprouted from a common root system which had originated as part of a earlier tree whose above-ground bole was cut or is no longer alive.

7. Select trees by the following species priority:

   a) Conifer species except for Pacific yew, incense cedar, and Port Orford cedar.

   b) Incense cedar and Port Orford cedar.

   c) Red alder and black cottonwood.

   d) All other hardwood species except for dogwood, cherries, willows, hollies, or species coded 999.

   e) Do not tally Pacific yew, dogwood, cherries, willows, hollies, or species coded 999. Within each level of species priority, select seedlings in order of dominance and vigor.

F. Tree and snag selection MQO

Tally tree selection:

MQO: Prism tree: No errors
Prism snag: No errors
Sapling: No errors
Seedling: No errors

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X. TRACKABLE TREE AND SNAG DATA

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X. TRACKABLE TREE AND SNAG DATA

Data recording
Record one line on the Husky data recorder for each tree sampled. Required data items for these trees vary by subplot, condition class and tree history. Use this section and the tally guides inside the front cover of the manual to determine which items to complete for a particular kind of tree.

If an accessible forest land condition class occupies part or all of a subplot's 55.8-foot fixed-radius plot, and there are no tree records for the condition class on the subplot except those with a tree history of 7 (snag) or 9 (reference-only), record one line with the subplot number, the condition class number, a tree history of "0" and enter "NO TALLY" in remarks. If all forest condition classes within subplot 1 are "NO TALLY", two additional records are required to reference subplot center; these reference records can represent sound stumps or snags, but live trees are preferable (see pages 17 and 19 for instructions on referencing subplots).

If both forest and one or more nonforest condition classes are mapped on a subplot's 55.8-foot fixed-radius plot, enter one line for each nonforest condition class; for each of these records, enter the subplot number, condition class number, and a tree history of 0, and enter "NO TALLY" in remarks.

Item 1--Line number (LINE #)

Printed/downloaded for Oc3 trees, snags, reference-only trees, and "no tally" records. New records are assigned a line number by the Husky data recorder. In either case, the line number should not be changed by the field crew.

A reference-only tree (tree history 9) recorded at Oc3 can be assigned a new line number so that the line can be used if the tree is now a sampled tree. If a mortality tree (tree history 5) qualifies as a snag (tree history 7) at Oc4, the new snag record uses the same line number assigned to the mortality tree record.

Item 2--SUBPLOT NUMBER (Sub Pl)

Record the subplot number where the tree occurs.

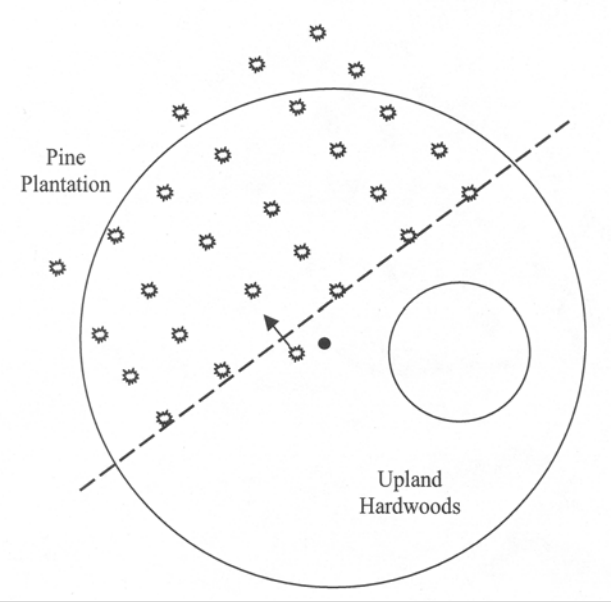
A 2-digit code recorded for all trees on all subplots. The second digit is the Oc4 subplot. At this inventory the first digit is also the Oc4 subplot (this is referred to as a " ## " subplot). Other first digit codes (N, C, or R) may be valid for other inventories. See Chapter III for further instructions.

When Collected: All live and dead tally trees ≥ 1.0 in d.b.h.*, reference only trees, seedlings*
Field width: 2 digits
MQO: No errors, 100% of the time
Values: *11, 22, 33, 44, 55*

Item 3--CONDITION CLASS NUMBER (Cc)

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary. See figure below.

When Collected: All live and standing dead tally trees ≥ 1.0 in d.b.h., *reference only trees, seedlings*
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9



Ragged condition class boundary and tree condition class designation.

Item 4--Tree history (TH)

1-digit code needed for all tally trees, snags and reference-only trees. Tree history indicates the current status of a tree record. Apply the following schedule for these variables:

When Collected: All live and dead tally trees ≥ 1.0 in d.b.h., reference only trees, seedlings
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

Condition Class Code	Tree History Code	Tree History Status	Tree History Description for ## Subplots
1	**1**	Remeasured	Tree tallied live at Oc3 and still live at Oc4.
1	**2**	New: reconstructed	Live tree in condition class 1 tallied for the first time at Oc4.
1	**3**	Culturally-killed	Tree tallied or reconstructed as live at Oc3 but now culturally-killed: killed by direct human activity and not utilized. It can be a standing, downed, or felled tree. Include trees killed by logging injury but not felled. A tree is culturally-killed only if it shows no sign of life or is partially uprooted, live, and has a bole that is touching the ground.
1	**4**	Oc4 ingrowth	Tree tallied live at Oc4 in NE quadrant of 10.8 foot fixed-radius plot which was not alive at Oc3 or was <1.0 in. d.b.h. at Oc3.
1	**5**	Mortality	Tree tallied or reconstructed as live at Oc3 but now dead. Death was natural and not due to human activity. A tree is dead only if it shows no sign of life. If the dead tree qualifies as a snag, record snag info on a separate line with the same 5-digit line # and a TH 7.
1	**6**	Missed tree	Live tree which should have been tallied at Oc3. Must be on a ## subplot in condition class 1 at Oc4. Requires reconstruction.
1	**7**	Snag	A standing dead tree which is ≥5.0 in. d.b.h., ≥4.5 feet tall, and has a bole that is not touching the ground. Can be self-supported by its roots or supported by another tree or snag. On remeasured subplots: leave as TH 7 a snag tallied at Oc3 but gone at Oc4; leave as TH 7 a snag tallied at Oc3 but <5.0 in. d.b.h. or <4.5 feet tall, or which has a bole which touches the ground at Oc4. Tally snags on remeasured subplots which have 'grown in' since Oc3 and died, and any snags missed at Oc3. Snags tallied at Oc3 that are still ≥5.0 in. d.b.h. and ≥4.5 feet tall, and with a bole which is not on the ground but are "out" at Oc4 with the prism are still snags at Oc4. A tree showing any sign of life does not qualify as a snag.
1	**8**	Harvested	A tree tallied or reconstructed as live and ≥5.0 in. d.b.h. at Oc3 but now harvested for industrial supply, firewood, local use or incidental

			now harvested for industrial supply, firewood, local use or incidental reasons.
≥1	**9**	Reference only	A tree, snag or stump which is a reference that is not a trackable tree. Includes TH 3, 5, and 8 in condition class 1 that are used as a reference; such references must be entered as a new reference tree record. Same for TH 7 in condition class 1 that no longer qualify as snags.
1	**0**	No live tally	Enter a line with TH=0 for each condition class without live tally trees (TH 1, 2, 4, 6) on a subplot. Includes subplots that are entirely nonforest.
≥1	**X**	Delete record	"X" deletes a record inadvertently entered or no longer needed.
≥2	**X**	Not tallied	Do not tally trees in condition class 2-5 at Oc4 on ## subplots.

Item 5--Species (SPC)

Record the appropriate species code from the list below. The code is downloaded/printed for trees tallied at Oc3. Change the downloaded/printed code if the species was misidentified at Oc3 and note "species misidentified" in remarks column.

When Collected: All live and standing dead tally trees ≥ 1.0 in d.b.h., *reference only trees, seedlings*
Field width: 3 digits
MQO: No errors for genus 100% of the time, no errors for species at least 95% of the time
Values:

Code	Common Name
011	Pacific silver fir (ABAM)
017	Grand fir (ABGR)
019	Subalpine fir (ABLAL)
022	Noble fir (ABPR)
042	Alaska yellow cedar (CHNO)
072	Subalpine larch (LALY)
093	Englemann spruce (PIEN)
098	Sitka spruce (PISI)
101	Whitebark pine (PIAL)
108	Lodge pole pine (PICO)
119	Western white pine (PIMO3)
122	Ponderosa pine (PIPO)
202	Douglas-fir (PSME)
231	Pacific yew (TABR2)
242	Western redcedar (THPL)
263	Western hemlock (TSHE)
264	Mountain hemlock (TSME)
312	Bigleaf maple (ACMA3)
351	Red alder (ALRU2)

Code	Common Name
361	Pacific madrone (ARME)
376	Western paper birch (BEPAC)
431	Giant chinkapin (CHCH7)
492	Pacific dogwood (CONU4)
542	Oregon ash (FRLA)
590	*Holly spp. (ILEX)*
600	Walnut spp. (JUGLA)
660	Apple spp. (MALUS)
746	Quaking aspen (POTR5)
747	Black cottonwood (POBAT) and hybrid populus spp.
760	Cherry, plum (PRUNU,PREM,PRVI)
815	Oregon white oak (QUGA4)
920	Willow (SALIX)
999	Other trees (identify in remarks) including FRPU7

Tally the following species as trees only if they are, or will become, trees. A tree is defined as a woody plant that commonly has a perennial stem that is ≥3.0 in. d.b.h. at maturity and a total height at maturity of ≥12 feet:

492	*Pacific dogwood*	*(Cornus nutalii)*	*(CONU4)*
590	*Holly spp.*	*(Ilex spp.)*	*(ILEX)*
760	*Cherry and plum spp.*	*(Prunus spp.)*	*(PRUNU, PREM, or PRVI)*
920	*Willow spp.*	*(Salix spp.)*	*(SALIX)*
999	*Cascara buckthorn*	*(Frangula purshiana)*	*(FRPU7)*

Although the following species occasionally attain tree size, they are always considered shrubs and are not tallied as trees:

Vine maple (Acer circinatum)
Mountain maple (Acer glabrum)
Douglas maple (Acer glabrum douglasii)
Sitka alder (Alnus sinuata)
Thinleaf alder (Alnus incana)
Serviceberry (Amelanchier spp.)
Manzanita (Arctostaphylos spp.)
Bog birch (Betula pumila)

Red or water birch (Betula occidentalis)
Bush chinquapin (Chrysolepis spp.)
Ceanothus (Ceanothus spp.)
Redbud (Cercis occidentalis)
Mountain mahogany (Cercocarpus spp. except Cercocarpus ledifolius)
Creek and redstem dogwood (Cornus spp. except Cornus nuttalli)
Hazel (Corylus spp.)
Hawthorne (Crataegus spp.)
Buckthorn (Frangula spp. except Frangula purshiana)
Silktassel tree (Garrya spp.)
Ocean spray (Holodiscus discolor)
Indian plum (Oemleria cerasiformis)
Mockorange (Philadelphus spp.)
Ninebark (Physocarpus spp.)
Rhododendron (Rhododendron spp.)
Elderberry (Sambucus spp.)
Mountain ash (Sorbus spp.)
Poison-oak (Toxicodendron spp.)
Arrowwood (Viburnum spp.)

Monumenting information
Tree azimuth, distance, and tree number are used to relocate subplots and the trees and snags tallied on subplots.

Item 6--Azimuth (AZM)
Record a 3-digit code describing the azimuth to the nearest degree, from subplot center to the tree or snag (specifically: ..to the tree number tag if present, or to the center of the base of tree or snag if not tagged). Printed/ downloaded on the trackable tree tally record for snags and for trees tallied live and ≥1.0 in. d.b.h. at Oc3. Change the downloaded/printed azimuth if more than 4 degrees in error if the Oc3 tally is still a snag, live tally, or reference. Use the magnetic declinations shown on page **23**. Code a north azimuth as "360".

When Collected: All live and standing dead tally trees ≥ 1.0 in d.b.h. *and all reference only trees*
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of time
Values: 001 to 360

Item 7--Slope Distance (DIST)
Record a 3-digit code indicating the slope distance from subplot center to the head of the nail that affixes the tree number tag, or to the front of the tree at the base if not tagged with a number. Printed/downloaded on the trackable tree tally record for snags and for trees tallied live and ≥5.0 in. d.b.h. at Oc3.

Required on all new Oc4 snags, new Oc4 trees tallied live including seedlings, and new trees that are reference-only.

Distance should be measured to the nearest 0.1 foot on tally requiring a distance if within 24 feet slope distance of subplot center. Tally requiring distance that are more than 24 feet from subplot center can be estimated to the nearest 3 feet. Distances on subplot references must be measured accurately to the nearest 0.1 foot regardless of distance to subplot center. The last digit of an estimated distance should be recorded as "0".

When Collected: All live and standing dead tally trees ≥ 1.0 in d.b.h. *and all reference-only trees*
MQO: *Trees tallied on 10.8 ft. seedling/sapling plot*: +/- 0.2 ft., at least 90% of the time
Trees within 24 ft.: +/- 1.0 ft., at least 90% of the time
Trees further than 24 ft.: +/- 3.0 ft., at least 90% of the time
Reference only trees: +/- 0.2 ft., at least 95% of the time
Values: 00.1 to 99.9

Item 8--Tree number (TRN)
A 3-digit code used to identify sampled trees which are ≥5.0 in. d.b.h. Printed/downloaded on the trackable tree tally record for trees sampled live and ≥5.0 in. d.b.h. at Oc3; change the recorded code if you change the tree number tag on one of these trees.

When Collected: See below

Field width: 3 digits
MQO: No errors, 95% of the time
Values: Blank, 1 to 999

On subplot 11:
All trees live and 5.0 in d.b.h. or larger sampled at Oc4 must be marked with an aluminum tree number tag and have the number recorded EXCEPT for trees that are references only.

For trees requiring a tree number tag: Reuse the old tree number tag if serviceable or attach a new tag. Be sure the tag is nailed to the tree below stump height and faces subplot center. The nail should be driven in only as far as necessary to firmly anchor it in the wood. When replacing an old tag, discard it. If an old tag cannot be removed, pound it in until flush with the bark so it will be overgrown and not confused with the new tag. Trees tagged previously that are culturally-killed, dead or harvested do not need retagging or maintenance.

Do not use a tree number more than once on the same plot Before leaving the vehicle, make sure the tree numbers previously assigned to downloaded trees are different than the numbers on the new tags you may use.

On ## subplots other than subplot 11:
Tree number tags are not required at Oc4 If a tag was installed at a previous inventory it may be left on the tree. New tally trees are assigned a Tree Number of "999".

Item 9--Oc3 to 4 Increment (INC)

A 3-digit code recording bored radial increment inside the bark to the nearest 1/20th inch for the period between Oc3 and 4.

When Collected: See below
Field width: 2 digits
MQO: +/- 1/20th per 1 inch of increment
Values: 1 to 999

Bored increment and reconstructed Oc3 d.b.h. is required for:

1. Conifers and red alders that are sampled live and ≥5.0 in. d.b.h. for the first time at Oc4 and are in condition class 1 on a ## subplot. Tree history is 2 or 4.

2. Conifers and red alders that were live and "in" but not tallied at Oc3 (missed tree) and are live and ≥5.0 in. d.b.h. at Oc4 in condition class 1 on a ## subplot. Tree history is 6.

3. Conifers and red alders with a downloaded Oc3 d.b.h. that is greater than Oc4 d.b.h. or unreasonably smaller than Oc4 d.b.h. This applies only to trees:
   a) sampled live at Oc3 and 4, and
   b) have an Oc4 d.b.h. ≥5.0 in. d.b.h., and
   c) are in condition class 1. Tree history is 1.

4. Conifers and red alders with tree history is 1 in condition class 1 whose Oc4 d.b.h. is obtained using "the half diameter" technique (page 105) BUT was measured conventionally at Oc3. (trees whose diameter grew and closed with another tree's diameter).

Do not bore hardwoods other than red alder ≥5.0 in. d.b.h. and do not bore any trees that are <5.0 in. d.b.h.; reconstructed Oc3 d.b.h. for these trees will be estimated by regression or other techniques.

To obtain radial increment:

1. Bore the tree just below breast height, on the side of the tree facing the point. If slope and tree size make this impossible, bore the tree on the side opposite the point.
2. Count the number of growth rings since Oc3 from the cambium end of the core (see below, or "Oc3 Remeasurement Period" on page **25** for the number of years to count).

3. Measure the length of this segment of the core to the nearest 1/20 in. to get radial increment. Enter this radial increment as the number of twentieths. e.g. 18/20 is recorded "18" and 27/20 is recorded "27" .

The data recorder will calculate and enter Oc3 d.b.h. upon entry of the increment and Oc4 d.b.h.

How to calculate Oc3 d.b.h. without a data recorder:
1. Multiply the radial increment by 2.2 to convert to diameter increment outside bark.
2. Divide by 20.
3. Determine Oc3 d.b.h. by subtracting the answer from step 2. from the measured Oc4 d.b.h.

The remeasurement period is **12 years** on a plot that has no date of Oc3 inventory. Use the following guide to determine number of tree rings to count on plots visited at Oc3. Diameter growth of most tree species in temperate forests of the western United States occurs between June 1 and August 1, and often happens largely in the early part of that period. The remeasurement period is calculated and displayed in the tree data section of the husky, and is entered in "**Error! Reference source not found.**" in PLOT ATTRIBUTES (see page **25**).

Jan	**Feb**	**Mar**	**Apr**	**May**	June	July	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
01	02	03	04	05	//////	//////	08	09	10	11	12
Do not count present inventory year if present date of inventory is one of these months					Count one year if present, previous or both, inventories were in these months		Do not count previous inventory year if previous date of inventory is one of these months				

Example 1: A plot in Clallam County was visited May, 1989 and revisited Sept, 2000: the number of growing seasons is 12 -- 1989 through 2000.

Example 2: A plot in King County was visited June, 1989 and revisited June, 2000: the number of growing seasons is 11 -- 1989 through 1999 (or 1990 through 2000).

Example 3: A plot in Cowlitz County was visited May, 1988 and revisited Aug, 2000: the number of growing seasons is 13 -- 1988 through 2000.

Example 4: A plot was visited Oct, 1988 in Mason County and revisited October, 2000: the number of growing seasons is 12 -- 1989 through 2000.

Item 10--Oc3 d.b.h. (Oc3 DBH)

A 4-digit code displaying Oc3 d.b.h. to the nearest 0.1 in. on live trees and to the nearest centimeter on snags. D.b.h. was measured on all live trees at Oc3 but crews were permitted to estimate d.b.h. on snags. Oc3 d.b.h. is downloaded/printed for all snags sampled ≥5.0 in. d.b.h. at Oc3 and all trees sampled live and ≥1.0 in. d.b.h. at Oc3. Some instructions for Oc3 d.b.h. are found in "Item 9--Oc3 to 4 Increment (INC)" (see page 101). The Husky data recorder will calculate Oc3 d.b.h. for live trees after entry of Oc3 to 4 Increment and Oc4 d.b.h.

- If a sapling missed at Oc3 is a conifer or a red alder, and now ≥5.0 in. d.b.h., bore for Oc4 increment. If an other hardwood species and ≥5.0 in. d.b.h., simply delete the generic Oc3 d.b.h. and leave Oc3. d.b.h. blank.
- Do not change Oc3 d.b.h. on snags sampled at Oc3 (even though Oc3 d.b.h. may differ considerably from the Oc4 d.b.h.)
- On remeasured (##) subplots in condition class 1, estimate Oc3 d.b.h. on snags that were snags at Oc3 but missed at Oc3.

Item 11--*Oc4* diameter at breast height (OC4 DBH)

A 4-digit code indicates Oc4 d.b.h. to the nearest 0.1 inch. Oc3 and Oc4 d.b.h. are used in calculating volume, growth, average stand diameter, and stocking-related estimates such as forest type and stand size.

Record for trees sampled live at Oc4. Record for all snags sampled at Oc4 that are ≥5.0 in. d.b.h. and ≥4.5 feet actual height, with a bole that does not touch the ground. Record on all established subplots. Diameter for seedlings is recorded as "0001".

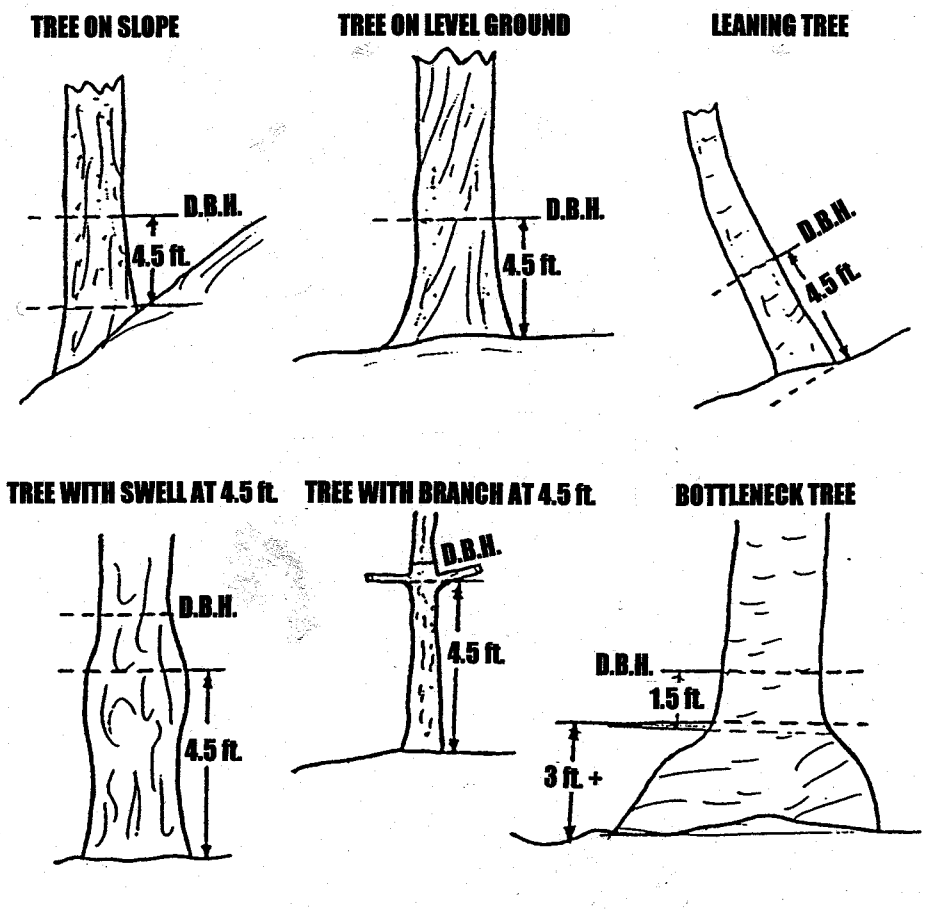
When Collected: All live and standing dead tally trees ≥ 1.0 in d.b.h.
Field width: 4 digits (xxx.y)
MQO: +/- 0.1 in. per 20.0 in of diameter on trees with a measured diameter, at least 95% of the time. For example: a tree with a diameter of 41.0 in would have a tolerance of plus or minus 0.3 in
Values: 0001 to 9999

Procedures for Oc4 d.b.h.

1. **Marking d.b.h. on trees previously marked:**
   The place where diameter was measured at Oc3 on trees tallied live and ≥3.0 in. d.b.h. at Oc3 was marked with an aluminum d.b.h. nail. On these trees, remeasure diameter at the location of the Oc3 nail. The old d-nail must be exposed enough so that it will not be overgrown in the next ten years (if possible). If the old nail cannot be pulled out to meet this requirement, set a new nail at the same location. If the old nail is missing, check the previous plot card for comments on the location of the old nail, and use this information to place a new nail on the bole. If there are no comments, follow the instructions in the next two paragraphs

2. **Marking trees and snags ≥3.0 in. d.b.h. tallied live for the first time at Oc4:**
   Set an aluminum nail at breast-height (4.5 feet above ground level from the root collar, measured at the uphill side of the tree or snag). On level ground, place the nail on the side of the tree facing the sample point. On a slope, place the nail on the uphill side of the bole. Leave as much of the nail exposed as possible, but be sure it is firmly affixed to the tree.

   Avoid irregularities in the bole when placing the nail on a new tree (see following figures). If the tree has swellings, bumps, depressions, or branches at breast-height, set the nail immediately above the irregularity, at a point where the stem has normal form. For trees sprouted from a stump, set the nail 4.5 feet above the point where the sprout leaves the stump.



3. General instructions on marking diameter:
If a tree or snag (new or remeasured) is 30.0 in. d.b.h. or larger, affix an additional nail for every additional (above 30.0 in.) 12 in. of diameter, distributing the nails evenly around the circumference of the bole. Set these nails while the diameter tape is girdling the tree at the point of diameter.

In tree remarks, note the distance from the root collar to the nail if this distance is less than 4.3 ft. or greater than 4.7 ft.

4. Measuring d.b.h.:
Measure d.b.h. directly above the d.b.h. nail. On trees without d.b.h. nails (trees less than 3.0 in. d.b.h.), measure d.b.h. at a point 4.5 feet above ground level.

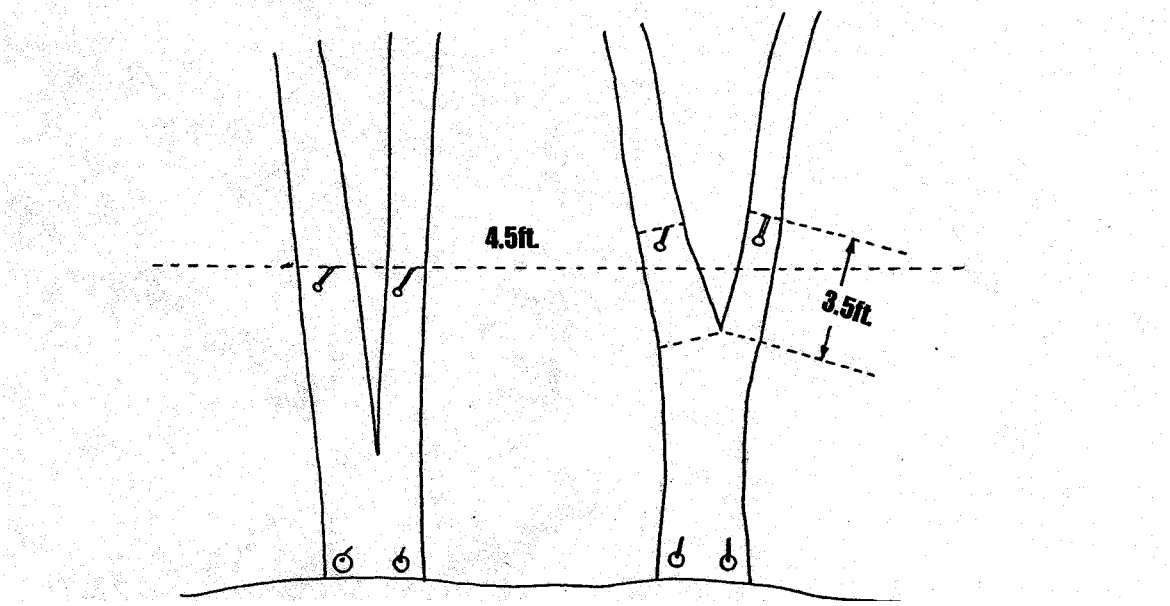
Before measuring d.b.h., pull any poison oak or other vines, slugs, or anything else that may affect the diameter measurement away from the bole of the tree and wrap the diameter tape underneath this material. Do not chop, or otherwise remove moss or vines. It may sometimes be necessary to remove a dead branch. Remove dead limbs only if the accuracy and efficiency of the measurement would be increased. Never remove live limbs!

5. How to measure d.b.h. under special circumstances:

a) Diameter on forked trees sampled previously: Tally remeasured trees the same way they were tallied previously; if a forked tree qualified at Oc3 as two tally trees, treat it as forked and two tally trees at Oc4. Each fork ≥5.0 in. d.b.h. or larger must be marked with a tree number tag on the side of the tree base where the fork occurs.

b) Diameter on forked trees sampled for the first time: Crotch of fork at or above 4.5 ft.. Consider as a single tree. Measure diameter below the swell caused by the fork, but as close to 4.5 ft. as possible.

c) Crotch of fork below 4.5 ft.: Consider each fork as a separate tree. Measure diameter at 4.5 ft. above the ground or 1.5 ft. above the crotch of the fork, whichever point is higher on the tree. Forks are tallied with the prism if the fork is "in" where d.b.h. is measured. Forks are tallied on the fixed-radius plots if the center of the tree at base is within the fixed-radius.



d) Diameter on trees that have grown together: When two tally trees have grown together at d.b.h., they may have the appearance of forked trees, but should be treated as separate trees.

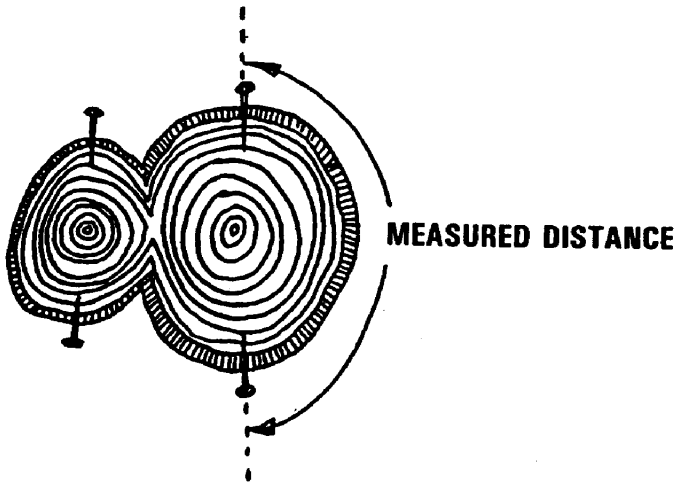
1. If the tree has a fully-measured diameter at a previous inventory, bore the tree for increment back to the time of last full diameter measurement. Fully-measured diameter means a diameter tape was extended completely around the tree to get the measured diameter. Increment is bored--if possible--on the side of the tree facing the subplot. Bore at the height the previous diameter was taken.

   Multiply the radial increment by 2.2 to get diameter increment (outside bark) since Oc3. Add this diameter increment to the previous measured diameter to get the current (Oc4) diameter. Record the Oc4 diameter.

   Divide the Oc4 diameter by two to determine a "half" diameter. Use the half diameter to place two diameter nails on the tree. Set the first nail at the height the previous diameter was measured. Use a diameter tape to measure out the half-diameter distance from the first nail. Set the second nail at the end of the taped half-diameter distance. Enter "half diameter" in remarks.

2. If the tree is a remeasured tally tree with a "double-nailed diameter" from a previous inventory, measure the half-diameter indicated by the two diameter nails. Multiply the half diameter by two. Record the result as Oc4 diameter. Note "double nail diameter" in remarks.

3. If the tree is a new tally tree, set two diameter nails at d.b.h. halfway around the tree's circumference from each other. Measure the distance between the nails with a diameter tape. Multiply the measurement by 2 and record the result as Oc4 diameter.



Example: Distance measured = 12.8 in.
12.8 X 2 = 25.6 in.

e) Impossible to measure trees: If it is physically impossible to measure the diameter of a tree with a diameter tape because of huge forking, root collars, cliffs etc. then estimate the diameter as follows:
   1) Determine where d.b.h. should be measured. Mark d.b.h. with a diameter nail, if possible.
   2) Using a prism as a guide, move to a point on the ground at which the tree becomes borderline.
   3) Measure the horizontal distance from this point to the center of the tree. This is the tree's limiting distance.
   4) Using the limiting distance table on page 165, look up the diameter for this limiting distance.
   5) Record this diameter in Oc4 d.b.h. and enter "Prism-estimated d.b.h." in the remarks column. Bore for Oc4 radial increment if required in Item 9--Oc4 increment.

f) Diameter on stump: Use a logger's tape, cloth tape or ruler to measure the longest and shortest axis across the top of the stump. Record Oc4 d.b.h. as the average of the two measurements.

Item 12--Oc3 height (Oc3 HT)

A 3-digit code indicating the total (normally-formed) height on live trees, and actual (not reconstructed) height on snags sampled at Oc3. Oc3 height is downloaded/printed for all trees sampled live and ≥5.0 in. d.b.h. with a field-measured height at Oc3 and for all snags sampled ≥5.0 in. d.b.h. at Oc3 (Snag heights were estimated to the nearest 3 feet). Do not change the downloaded/printed Oc3 height on trees and snags even if the Oc4 height is greater than the Oc3 height. If this occurs, recheck that the Oc4 height is accurate.

Field-measured Oc3 tree heights will be marked as such on the downloaded/printed records. Height was recorded to the nearest meter (3.28 ft.) on snags at Oc3.

When Collected: See below
Field width: 3 digits
MQO: +/- 10% of true length, at least 90% of the time
Values: 5 to 300

The only Oc3 heights to collect: On remeasured (##) subplots in condition class 1, estimate Oc3 height on snags that were snags at Oc3 but missed at Oc3.

Do not record Oc3 height for trees sampled live at Oc3 which are still live and show no downloaded/printed Oc3 height.

Item 13--Oc4 height (OC4 HT)

A 3-digit code indicating the total height of the tree to the nearest foot.

When Collected: See below
Field width: 3 digits
MQO: Trees < 60 ft.: +/- 5% of true length, at least 90% of the time
Trees ≥ 60 ft.: +/- 10% of true length, at least 90% of the time
Values: 1 to 25 for trees < 1.0 in. d.b.h.
5 to 300 for trees ≥ 1.0 in. d.b.h.

Do not change a downloaded/printed Oc3 height even if it is greater than the Oc4 height; if Oc3 height exceeds Oc4 height, double-check that the Oc4 height is accurate.

Record a field-measured or field-estimated height for:

1. All trees sampled live at Oc4.
2. All snags that are ≥5.0 in. d.b.h. and ≥4.5 ft. tall and have a bole which does not touch the ground.

For trees live and <5.0 in. d.b.h. at Oc4 on each 10.8 foot fixed-radius subplot:

1. Measure total Oc4 height on first sapling (1.0-4.9 in. d.b.h.) tallied clockwise from north that meets the following criteria: a) the tree is an estimated 15 feet or more tall and b) has a live, normally-formed height.
2. Then, estimate or measure actual height on all other live saplings and seedlings.

For trees live and ≥5.0 in. d.b.h. at Oc4 on each subplot:

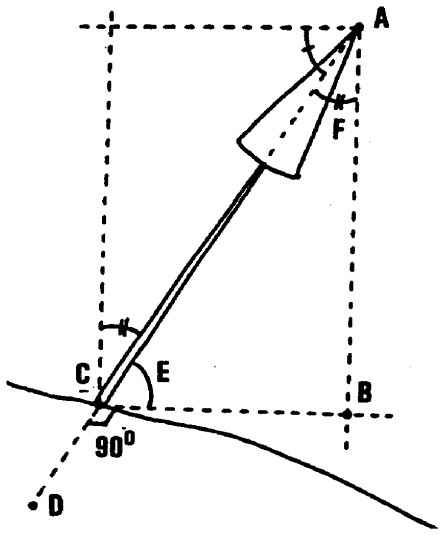
1. Measure Oc4 height on the first tree tallied clockwise from north that has a downloaded Oc3 height and a normally-formed height. If the Oc4 height is less than the downloaded/printed Oc3 height, make sure the Oc4 height is accurate; the data recorder will prompt that the discrepancy exists. Do not change the Oc3 height even if it greater than the Oc4 height.
2. If no tree with a downloaded Oc3 height qualifies for height remeasurement, then measure Oc4 height on the first tree encountered clockwise from north that has a normally-formed height.
3. Measure Oc4 height on an additional tallied tree with a normally-formed height and d.b.h. of ≥5.0 in. Select a dominant or codominant tree, if available.
4. Then, measure or estimate normally-formed height for the remaining trees ≥5.0 in. d.b.h.

Normally-formed height: A conifer with a normally-formed height has a central bole and no deformities (such as a crook, fork, or missing or dead top). A hardwood with a normally-formed height has a complete bole with no missing top. Some hardwood species (e.g. alder and cottonwood) typically have a single bole well up into the crown. Other species (e.g. oak, maple, ash, and madrone) typically fork much lower on the bole - a condition that represents normal form and height for these species.

Height on poorly-formed trees: Reconstruct total (normally-formed) tree heights by estimating what the height would be were there no deformity in the main bole. Deformities include missing tops, and large crooks and forks above 4.5 feet. As a basis for estimating the normally-formed height, measure the tree's actual (poorly-formed) height and examine normally-formed trees of the same species and age in the same stand. A tree with reconstructed Oc4 tree height is coded with an "R" in the column to the right of Oc3 height (example: 092R).

Height on leaning trees: Measure or estimate total normally-formed bole length (from the base to the tip of the tree), and not the perpendicular from the ground to the tip. To measure heights of leaning trees using a clinometer, follow these steps:

1. Move to a point along a line (point D) that is perpendicular to the plane in which the tree is leaning.

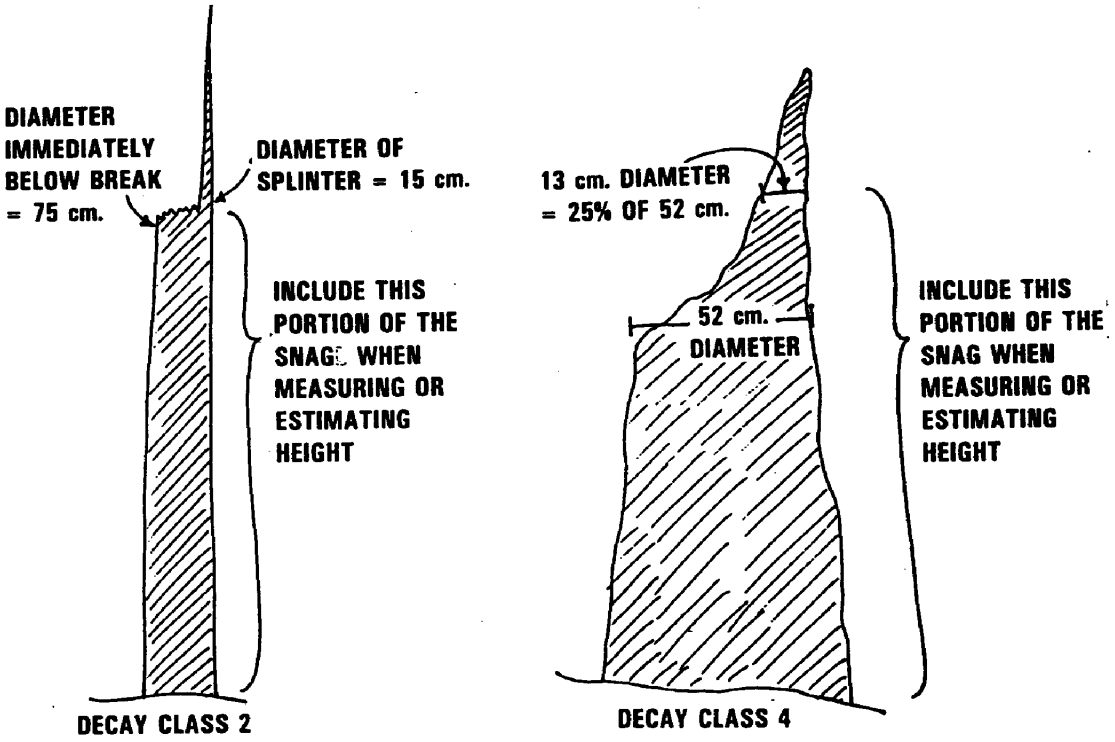


2. Using your clinometer, measure the height of point A above point B.
3. By standing at the base of the tree and sighting up the bole with your clinometer, measure the slope of the bole in degrees. (Angle E in the diagram above)
4. Subtract the degrees of lean (step 3.) from 90 degrees. This gives you the degrees of angle F.
5. By sighting through your clinometer, convert the angle calculated in step 4 to a percentage.
6. Use the slope correction table on page 163 to determine the expansion factor for the percent slope determined in step 5. Multiply the expansion factor by the measured distance from point A to point B (step 2). This gives the length of the bole (point A to point C).

Height on a tree forked below d.b.h. (tallied as two or more trees): The height of the tallest stem shall include the height of the main bole below the fork. The height(s) of the other stem(s) shall be only height from fork to top.

Height on snags: Snag height is always actual height, the distance from the ground to the actual top of the snag; do not include missing tops as part of the recorded height. Snag height, recorded to the nearest foot, may be measured or estimated.

Snags often have broken, irregular tops. When measuring or estimating heights on such snags, use the "25-percent" rule to determine the point on the bole to which height should be taken. Include as part of the height, shattered or splintered segments up to the point where the diameter of the "broken" segment has a diameter that is 25 percent of the diameter of intact bole just below the broken portion. See diagram below.



Item 14--Oc4 height method (HT M)

A 1-character code indicating the method used to determine Oc4 tree height.

When Collected: All trees on which an Oc4 height is collected
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

Code	Oc4 height method
M	measured height
E	estimated height
R	reconstructed height

Item 15--Breast height age (BH AGE)

A 3-digit code indicating age at breast height. This variable is used in determining stand age, and in developing regression estimators of tree growth, mortality and harvest. On trees sampled live at Oc3, BH age is downloaded/printed; if bored for age previously, age is followed by an asterisk "*". Oc3 BH age on these trees has been updated to Oc4 (2000).

Field width: 3 digits
MQO: Trees with measured age: +/- 10%, at least 90% of the time
Trees with estimated age: +/- 20%, at least 90% of the time
Trees with extrapolated age: +/- 30%, at least 90% of the time
Values: 1 to 999

All live tally trees $\geq$4.5 feet tall require breast-height age. Age may be estimated, but bored ages are always preferred. For trees $\geq$4.5 feet tall that are reconstructed as live at Oc3 and culturally-killed, dead, or harvested since Oc3, estimate breast-height age at the time of demise.

Do not change the downloaded/printed age for trees sampled live at Oc3 that were culturally-killed, died or were harvested since Oc3; their age will be backdated in the office by computer.

If available, bore on each subplot at least one live conifer or alder tally tree ≥5.0 in. d.b.h. not previously bored; pick trees representative of the range of species, tree sizes and age classes present on the plot. Estimate age for trees tallied for the first time using the bored ages as a guide. Examine and correct, as needed, the downloaded/printed breast-height ages on trees that are still live tally.

Special case: Bore for breast height age, any conifer or red alder with a tree history of 1, 4, or 6 and with an Oc4 d.b.h. ≥5.0 in. d.b.h. that was <1.0 in. d.b.h. at Oc3.

If you bore the tree for a breast-height age, record an "+" to the right of age. If you can determine breast-height age accurately by counting branch whorls on pines and true firs <5.0 in. d.b.h. and Douglas fir seedlings, record a "+" to the right of age. The "+" to the right of age is entered on the Husky data recorder by typing a "V" after the age.

After boring a tree for age, leave the extracted increment core at the base of the tree (for the convenience of the check-plotter!).

Determining breast-height age of large trees: To determine the age of a tree whose radius is greater than the length of the increment borer, use the following procedure:

1. Bore into the tree as far as possible, extract the core, and count the rings.
2. Count the number of rings in the inner 2 inches of the core.
3. While the increment borer is still in the tree, measure the length of the borer that is exposed.
4. Subtract this length (3) from the total length of the increment borer.
5. Divide the tree's d.b.h. by 2.
6. Subtract (4) from (5). This gives you the distance by which you are short of reaching tree center.
7. Divide this number (6) by 2. This tells you how many 2-inch lengths you were short by.
8. Multiply this number (7) by the number of rings in inner 2 inches (2).
9. Add this number (8) to the total number of rings in the extracted core (1). This is the tree's estimated breast-high age.
10. Note "extrapolated age" in the remarks column.

Example: Determine the age of a 59.6-inch Douglas-fir. The core has 110 rings, and has 10 rings in the inner 2 inches. 0.8 in. of the 16.4-inch-long increment borer did not penetrate the tree. Each number below is associated with its corresponding step above:

Step 1: **110** rings counted
Step 2: **10** rings in the inner 2 in. of the core
Step 3: **0.8** in. is the length of the borer which is exposed
Step 4: 16.4 in. is the total length of the borer – 0.8 in. which is the exposed length = **15.6 in.**
Step 5: 59.6 in. is the tree's d.b.h. and you then divide by 2 = **29.8** in. to center of tree (pith)
Step 6: 29.8 in. (true center) – 15.6 in. (measured core) = **14.2** in. short of reaching the pith
Step 7: 14.2 in./ 2 = **7.1 (2 in.) lengths short**
Step 8: 7.1 (from step 7) x 10 (from step 2) = **71** rings not counted
Step 9: 110 rings counted (step 1) + 71 rings not counted (step 8) = **181 years old at breast height**
Step 10 In the remarks column note **"extrapolated age"**

Item 16--Oc3 crown ratio (C)

A 1-digit code downloaded/printed for all trees tallied live at Oc3. Codes are the same described in "Oc4 crown ratio". Change the downloaded/printed code if obviously incorrect. Estimate Oc3 crown ratio for reconstructed trees. Use the same procedures and codes listed for Oc4 Crown Ratio.

MQO: +/- 1 class, at least 90% of the time, distinguish between codes ≤3 and ≥4 100 % of the time

Item 17--Oc4 crown ratio (R)

Record a 1-digit code for all trees tallied live. Compare the Oc4 estimate with Oc3 crown ratio, if downloaded, for reasonableness and continuity.

Crown ratio is the percent of a tree's total height that supports living crown. Total height includes dead, broken, or missing portions of the tree. For trees of uneven crown length, ocularly transfer lower branches on the fuller side to fill holes on the sparse side until a full, even crown is created. Base your estimate on this "created" crown.

When Collected: All live tally trees ≥ 1.0 in d.b.h.*, seedlings*
MQO: +/- 1 class, at least 90% of the time, distinguish between codes ≤3 and ≥4 100 % of the time
Values:

Code	Percent Live Crown
1	01 - 10
2	11 - 20
3	21 - 30
4	31 - 40
5	41 - 50
6	51 - 60
7	61 - 70
8	71 - 80
9	81+

Crown ratio is an indicator of a tree's vigor. In data analysis, trees with a crown ratio of 30 percent or less are considered less vigorous. For this reason, be particularly careful when deciding between codes "3" and "4." You may want to use your clinometer to measure live crown ratios on these trees.

Item 18--Oc3 crown class (C)

1-digit code downloaded/printed for all trees tallied live at Oc3. Codes are the same described in "Oc4 crown class". Change the downloaded/printed code if obviously incorrect. Estimate Oc3 crown ratio for reconstructed trees. Use the same procedures and codes listed for Oc4 Crown Class.

Item 19--*Oc4* CROWN CLASS (C)

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (see diagram below). Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree which is now dominant due to tree removal is classified as dominant.

Compare the Oc4 estimate with Oc3 crown class, if downloaded, for reasonableness and continuity. Crown class describes a tree's "social" position in the stand and may indicate how well the tree is competing for light.

For Oc4 crown class, record the crown class that describes a tree's current social position. Oc3 and Oc4 crown classes for a tree may differ. For example, a tree was classified as an intermediate tree with its crown mostly beneath the canopy of a dense stand at Oc3. At Oc4, the tree stands alone in full sunshine from above and on its sides because its neighboring trees were removed in a heavy partial harvest; the tree is classified at Oc4 as a dominant or open grown tree.

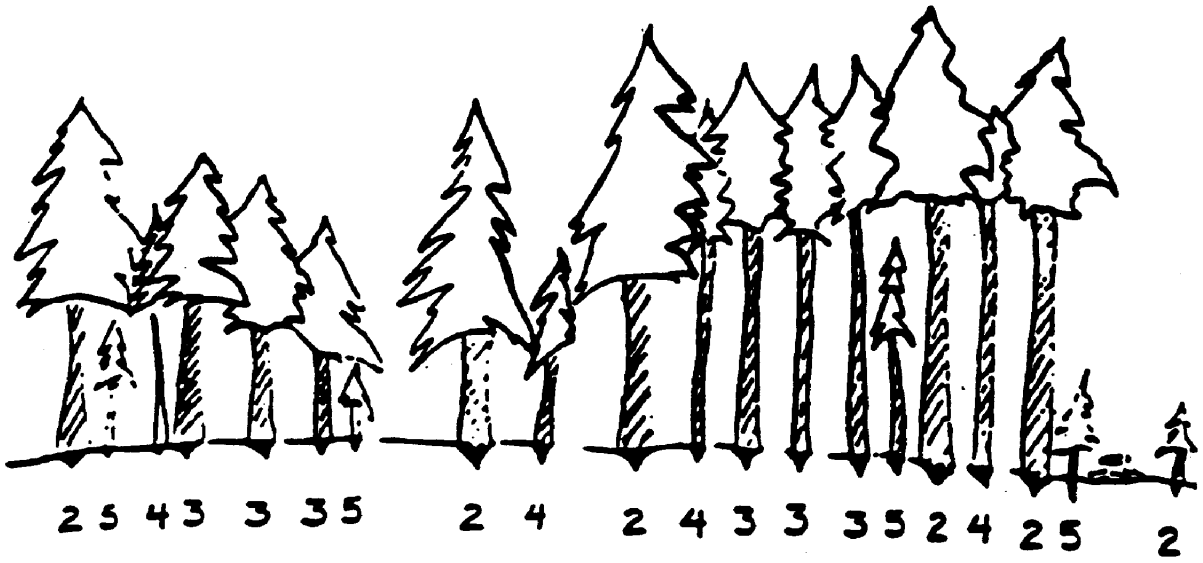
Crown classifications are easily applied in even-aged stands. Classifications are more difficult to assign in uneven-aged stands or in plots where more than one stand is present. In these situations, classify the tree based on its immediate environment. In other words, base your classification on how much light the tree's crown is receiving, not it's position in the canopy. The intermediate and overtopped crown classes are meant to include trees seriously affected by direct competition with adjacent trees.

For example, a young, vigorous tree that is considerably shorter than other trees in the stand-but that is not overtopped by other trees and that receives full light from above and partly from the side-is classified as dominant. The same principle applies to two-storied stands: understory trees should

only be assigned subordinate crown classes if they are adjacent to overtopping trees. In plots with scattered residual overstory trees over younger trees, a considerable portion of the understory trees will be classified as dominant or codominant.

When Collected: All live tally trees ≥ 1.0 in d.b.h., *seedlings*
Field width: 1 digit
MQO: No errors, at least 85% of the time
Values:

Code	Crown class	Definition
2	Dominant	Trees with crown extending above the general level of the crown cover and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.
3	Codominant	Trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, codominant trees have small-sized crowns and are crowded on the sides.
4	Intermediate	These trees are shorter than dominants and codominants, but their crowns extend into the canopy of codominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediates usually have small crowns and are very crowded from the sides.
5	Overtopped	Trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides



Item 20--MISTLETOE CLASS (M)

Record a code indicating the extent and severity of mistletoe infection for all live conifer and oak trees ≥ 1.0 in. d.b.h./d.r.c.

Rate all live conifer species, except juniper species *and incense cedar*, ≥ 1.0 in diameter for dwarf mistletoe (*Arceuthobium* spp.) infection. Use the Hawksworth six-class rating system: divide the live crown into thirds, and rate each third using the following scale.

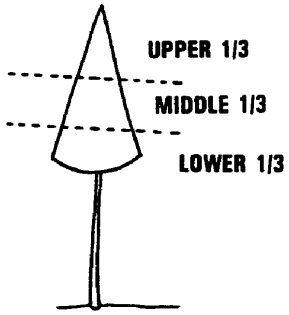
Code	Mistletoe	Description
0	No visible infection	None
1	Light infection	< 50 percent of the total branches infected

2	Heavy infection	> 50 percent of the total branches infected

Sum the three individual ratings to obtain a total mistletoe class (0 to 6) for the tree.

Example: A conifer tree has no infection in top third of crown, light infection in the middle third, and has many brooms in the lower third.

The total score is: 0 + 1 + 2 = 3; the code is: "3"



Rate all juniper species, incense cedars, and oak trees for leafy mistletoe infection. This item is used to describe the extent and severity of mistletoe infection. Rate leafy mistletoe on juniper, incense cedar and oaks using the following criteria:

Code	Description
0	No leafy mistletoe is present
7	Leafy mistletoe is present

When Collected: All live conifer and oak trees ≥ 1.0 in d.b.h./d.r.c.
Field width: 1 digit
MQO: +/- 1 class, at least 90% of the time
Values: 0 to 6: Conifer (except juniper and incense cedar) trees ≥ 1.0 in d.b.h./d.r.c.,
0, 7: Juniper species, incense cedar, and oaks

Platform and Moss Abundance
Platform and Moss Abundance data are collected on qualifying trees located on plots where Plot Attribute **Error! Reference source not found.** (see page **24**) =1.

Selection of Viewing Position: Select a position, preferably on the uphill side of the tree, that provides the clearest view of as much of the tree bole and crown area as possible to estimate platform and moss abundance. As an optional field aide to the inspection process, measure the azimuth and slope distance from the position at which measurements are made to the base of the tree being evaluated. Record the azimuth and slope distance, if collected, in the Tree Comments section for the tree.

The Azimuth/Distance (an optional field) for the tree viewing position selected is used to assist in the inspection process only. When recording viewing position, complete azimuth to the nearest degree and slope distance to the nearest foot. For example, 061/051 is equivalent to 61 degree az. and 51 feet distance. Record in the Tree Comments field. If viewing position azimuth/distance is not recorded, the check plotter's determination of best viewing position will be utilized.

Item 21--Platform abundance (PLAT)
Count the number of limbs that contain one or more platforms. Each limb with one or more platforms is counted only once, regardless of the number of platform structures on the limb. Limb counts from 1 to 9 shall be tallied as individuals (i.e. 1, 2, 3, etc.). A tree with 10 or greater limbs with one or more platforms shall be tallied as 10. Counts will be summarized into the groups: 0, 1-5, 6-9, ≥10.

A platform is a section or area of a limb that is >6.0 in. diameter, located >33.0 feet above the ground up to the top of a live crown of a tree, and not positioned at more than a 45 degree angle. This includes limb areas where the diameter has been enlarged by effects of insects, mistletoe, disease, physical injury, or the accumulation of moss.

When collected: All live trees ≥20.0 in. d.b.h. on plots where **Error! Reference source not found.** = 1
Field width: 2 digits
MQO: Correct group, at least 75% of the time
Values: 0 to 10

Item 22--Moss abundance (MOSS)

Estimate the percentage of the surface area on the horizontal surface or top of each limb covered by moss ONLY; do not include other epiphytes, such as lichens. From the same point used to estimate Platform abundance (Item 21), estimate moss coverage on the horizontal surface of all visible limbs in the lower two thirds of the live tree crown. Estimate the percent cover of moss on the top of each limb, then average across ALL limbs within the lower two thirds of the live crown. Record the result for each tallied tree to the nearest percent from 0 to 99.

Moss is any of various green, nonvascular plants of the class Musci of the division Bryphyta that usually form a mat-like surface on a limb.

When collected: All live trees ≥20.0 in. d.b.h. on plots where **Error! Reference source not found.** = 1
Field width: 2 digits
MQO: +/- 20%, at least 75% of the time
Values: 0 to 99

Item 23--Hardwood clump (CL)

If a hardwood is part of a clump, the clump is assigned a clump number, and the number is recorded for each hardwood tallied that is part of the clump. If a hardwood is not part of a clump, "0" is recorded for the tree. Clumps with tallied trees are numbered in consecutive order on a subplot starting with "1".

Example: Maple trees in three different maple clumps are tallied on a subplot. Trees tallied that are in the first clump are coded "1" for hardwood clump. Trees tallied that in the second clump are coded "2" for hardwood clump, and trees tallied that in the third clump are coded "3" for hardwood clump.

A clump is defined as 3 or more live hardwood stems originating from a root system from a tree now gone. Hardwood clumps typically arise from old stumps that are left from cutting or from natural mortality. Each fork of a forked tree counts as one stem if the fork is below d.b.h. and must be entered on a separate line. Do not tally seedling-sized suckers that have sprouted from the base of a live, unsuppressed hardwood stem that is ≥5.0 in. d.b.h.

Clump data are used in adjusting stocking estimates; trees growing in clumps contribute less stocking than those growing as individuals.

When collected: All live hardwood trees on ## subplots
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values: 0 to 9

Item 24--Cull other/hardwood form class (CO)

This item is used in calculating net tree volume. For conifers, a 2-digit code indicates the percent of volume--to the nearest one--percent--of the volume lost due to form, generally, forks or crooks. For hardwoods, a 1-digit code indicates the tree's form. The code is recorded only on trees ≥5.0 in. d.b.h. Do not code for trees culturally-killed, dead or harvested that are reconstructed as live at Oc3.

Cull other--Conifers ≥5.0 in. d.b.h.

For conifers sampled live and ≥5.0 in. d.b.h. at Oc4, record a 2-digit code to indicate the percent of sound cull. Code only when 3 ft. or more of the tree is defective. Record the reason for the Oc4 deduction by recording an damaging agent code in Item 26, 28, or 30; a severity rating is not required.

This item has been downloaded/printed for conifers sampled live and ≥5.0 in. d.b.h. at Oc3. If still live tally, use the printed code only as a guide. Determine percent cull according to the current rules, and correct the downloaded/printed codes if obviously in error. For conifers now culturally-killed, dead or harvested which were ≥5.0 in. d.b.h. at Oc3, downloaded "ROUGH CULL" should not be changed and coding of damaging agent is not required.

Field width: 2 digits
MQO: +/- 10%, at least 90% of the time
Values: 00 to 99

If the conifer does not have a minimum log (12.0 ft.), code this item "99."

Use the following guide and tables showing merchantability standards and the percentage distribution of volume by log, to determine the percent of Cull Other on conifers.

1. **Fork:** When the crotch of the fork is below 4.5 feet, treat as separate trees with no cull. When the crotch of the fork is above 4.5 feet, cull only if additional volume in a second stem does not compensate for the volume reduction in the main stem. Forked trees often have as much or more volume than trees without forks.

2. **Crook:** Cull for 3.0 ft. or more of buck-out loss.

Conifer merchantability minimums

	Size class (in.)	Stump height (ft.)	Log length (ft.)	Minimum top diameter outside bark (in.)
Poletimber	5.0-8.9	1.0	8.0	4.0
Sawtimber	9.0+	1.5	16.0	7.0

Percentage distribution of total tree volume for sawtimber conifers (9.0 in. d.b.h. and larger)

(16.0 ft. logs)

Tree height (in logs)	Log number											
	1	2	3	4	5	6	7	8	9	10	11	12
1	100											
2	70	30										
3	55	35	10									
4	41	31	20	8								
5	32	27	21	14	6							
6	27	23	19	15	11	5						
7	23	20	17	15	12	8	5					
8	20	18	16	14	12	9	7	4				
9	17	16	15	13	11	10	8	6	4			
10	16	15	13	12	11	10	8	7	5	3		
11	14	13	13	11	11	10	8	7	6	4	3	
12	14	13	12	11	10	10	8	7	6	4	3	2

Percentage distribution of total tree volume for hardwoods and poletimber conifers (conifers 5.0-8.9 in. d.b.h.)

(8.0 ft. logs)

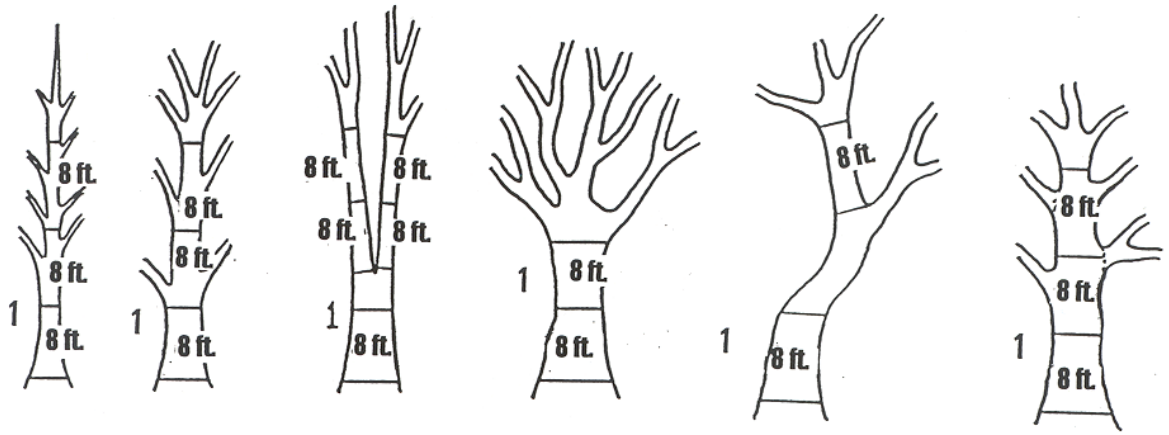
Tree height (in logs)	Log number									
	1	2	3	4	5	6	7	8	9	10
1	100									
2	55	45								
3	41	33	25							
4	33	28	22	17						
5	28	24	20	16	12					
6	25	22	18	15	12	8				
7	22	20	17	14	12	9	6			
8	20	18	16	14	11	9	7	5		
9	18	17	15	13	11	9	7	6	4	
10	17	16	14	12	10	9	8	6	5	3

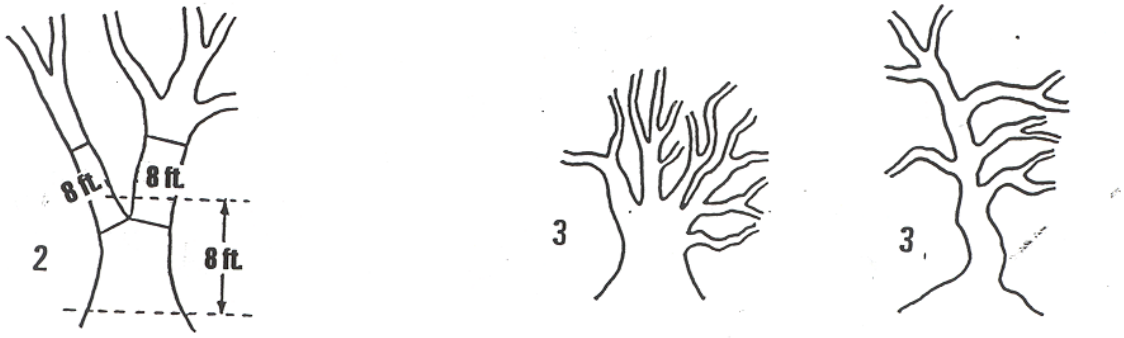
Hardwood form class--Hardwoods ≥5.0 in. d.b.h.

Hardwood tree form is entered in Cull Other. Record for all new live hardwood trees tallied that are ≥5.0 in. d.b.h.. Do not record for reconstructed hardwood trees ≥5.0 in. d.b.h. that have died, or have been killed or harvested. Coding of damaging agent is not required to describe hardwood Cull Other.

Code	Hardwood form class
1	First 8 feet above stump is straight. (A log is considered straight if a line drawn through the centers of both ends of the log does not pass outside the curve of the log.)
2	First 8 feet above stump is NOT straight; but must have at least one straight log elsewhere in the tree.
3	No logs anywhere in tree due to form. Includes the sea serpents, octopi, giant tumbleweeds, pretzels, cauliflowers, and various free form trees.

HARDWOOD TREE FORMS





Item 25--Cull rot (CR)

Record a 1-digit code for all trees sampled live and >5.0 in. d.b.h. Cull rot is downloaded/printed trees sampled live and >5.0 in. d.b.h. at Oc3, and if still live, update the cull rot code according to the current rules and correct the code if obviously in error. Do not record for reconstructed hardwood trees >5.0 in. d.b.h. that have died, or have been killed or harvested.

Record the reason for the Oc4 cull rot codes of 1, 2 or 3 by recording an damaging agent code in Item 26, 28, or 30; a severity rating is not required.

When collected: All live tally trees ≥ 5.0 in.
MQO: +/- 1 class
Values:

Code	Cull rot percent
0	0-9
1	10-39
2	40-74
3	75-100

Information on Cull rot is used with information on ROUGH CULL to calculate the net volume of trees.

The following procedures apply in determining cull rot coding:

1.) Determine if the bole is at least 10-percent rotten. Code "0" if none of the following indicators are present:

a) Open or closed trunk wound over 10 years old and in contact with the ground.

b) Open trunk wound with visible rot, or a closed trunk wound over 10 years old. To qualify, the wound must be either 10 feet long in the lower half of the bole, or 16 feet long in the top half of the bole.
c) The tree is a conifer and has, in the lower 1/3 of the bole, 2 or more crooks or forks which indicate past top out.
d) A swollen or hollow butt.
e) Large rotten knots or limb stubs.
f) Conk(s).

2.) If one or more of these indicators are present, use the following guide to assign a rot code:

Code 3: Assign a "3" if one or more of the following is present:
a) Echinodontium tinctorium or Phellinus pini conks present and spread along 60 percent or more of the bole.
b) Echinodontium tinctorium or Phellinus pini conks present and spread along 30-59 percent or more of the bole, and top is missing.
c) 30-59 percent of bole is rotten and top is out.
d) 60 percent or more of merchantable bole from the ground up is rotten.
e) Oligoporus amarus (Polyporus amarus) rot, conk or shot hole cup present on incense cedar.
f) Tree is a hardwood >200 years old and any amount of rot is present.

Code 2: Assign a "2" if one or more of the following is present:
a) Echinodontium tinctorium or Fomitopsis officinalis (fomes officinalis) are present.
b) Phellinus pini conk(s) spread along 30-59 percent of the bole.
c) 30-59 percent of bole is rotten.

Code 1: Assign a "1" for the presence of indicators that are not listed under code 2 or 3 and the bole is at least 10 percent rotten.

Items 26 through 31--Damaging agent/severity (Agt, S)

Damaging agent: a 2-digit code entered, if needed, in three agent fields (Item 26, 28, and 30). Severity: a 1-digit code entered, if required, in three severity fields available (Item 27, 29, and 31). For all trees tallied live at Oc4, record up to 3 damaging agents, each with a severity rating (if required).

The agent and severity codes are used to indicate the type of agents present on a tree and describe their severity. Several damaging agents are automatically of highest importance and should be coded before any other agents; these agents carry an asterisk (*) after their name in the listing below. The order in which multiple damaging agents are recorded is otherwise arbitrary and need not imply a primary-secondary relationship. If more than three damaging agents are found on a tree, then code the three agents thought to have the most impact on forest conditions in the condition class.

Damaging agent and severity coding replaces the growth impactors collected at Oc3. For each tree sampled live at Oc3, growth impactor codes have been converted to comparable agent codes and downloaded/printed into Item 26, Agent 1. If still live at Oc4, inspect the tree to see whether the converted code is still valid, requires updating to a different agent present, or should be set to "00" which indicates "no damaging agents present". If additional agent(s) are present, code for them in Agent 2 and Agent 3. On trees live at Oc4, agent codes other than "00" each require a severity rating. Downloaded agent codes 27 and 52 always require updating to another code.

If a tree sampled live at Oc3 is now culturally-killed, dead, or harvested, do not change the downloaded code in Agent 1 nor enter a code in Severity 1. Trees dead or harvested, sampled live at Oc3 or reconstructed as live at Oc3 require a cause of death code or harvest use code entered in Agent 2 (Item 28), but Severity 2 (Item 29) is not coded, and no other agents or severities should be added elsewhere. Cause of death and harvest use are discussed on page 122.

Agents and their severity ratings are grouped by broad class. Each class has a general agent and specific agents listed. The general codes should be used if there is any question as to the identity of the specific damaging agent.

When collected: All live tally trees
MQO: Agents detected and classified in correct category, at least 90% of the time
Values:

Bark beetles:

Code	Agent
01	General/other bark beetle
02	Mountain pine beetle
03	Douglas-fir beetle
04	Spruce beetle
05	Western pine beetle
06	Pine engraver beetle
07	Fir engraver beetle
08	Silver fir beetle
09	Red turpentine beetle

Code	Severity
1	Unsuccessful current attack
2	Successful current attack
3	Last year's successful attack
4	Older dead
5	Top kill

Note: Bark beetles often attack trees weakened by root disease fungi. Carefully evaluate trees suffering bark beetle attack for evidence of root disease.

Defoliators:

Code	Agent
10	General/other
11	Western blackheaded budworm
12	Pine butterfly
13	Douglas-fir tussock moth
14	Larch casebearer
15	Western spruce or Modoc budworm
16	Western hemlock looper
17	Sawflies
18	Needle and sheath miners
19	Gypsy moth

Code	Severity
1 to 9	Divide live crown into thirds. Rate each third separately based on the following classes: 0 - No detectable defoliation 1 - Up to 33% of foliage (old and new) missing 2 - 34 to 66% of foliage missing 3 - 67 to 100% of foliage missing Obtain severity rating by adding ratings for each third. Record total.

Other insects:

Code	Agent
20	General
21	Shoot moths
22	Weevils
23	Wood borers
24	Balsam wooly adelgid (aphid)
25	Sitka spruce terminal weevil

Code	Severity
1	Bottlebrush or shortened leaders, 0-2 forks on the tree's stem, Or: less than 20% of the branches affected, Or: <50% of the bole has visible larvel galleries.
2	3 or more forks on the tree's bole, Or: 20% or more of the branches are affected, Or: the terminal leader is dead, Or: ≥50% of the bole has visible larval galleries.

White pine blister rust:

Code	Agent

Code	Severity

36	White pine blister rust	1	Branch infections located more than 2.0 ft. from tree bole.
		2	Branch infections located 0.5 to 2.0 in. from bole.
		3	Bole infections present, Or: branch infections within 0.5 ft. of bole.

Stem-branch cankers:

Code	Agent	Code	Severity
40	General/other	1	Branch infections present. <50% of the crown affected.
41	Western gall rust (Pipo, Pico)		
42	Commandra blister rust (Pipo)	2	Branch infections present. ≥50% of the crown affected, Or: any infection on the bole.
43	Stalactiform rust (Pico)		
44	Atropellis canker (Pinus spp.)		
45	Cytospora or Phomopsis (Psme, Abies spp.)		
31	Gymniosporangium (Juoc)		

Stem decays:

Code	Agent	Code	Severity
46	General/other	1	1 conk on the stem or present at ground level.
47	Red ring rot (P. pini)	2	2 or more conks separated by <1.3 ft. on bole.
48	Indian paint rot (E. tinctorium)	3	2 or more conks separated by ≥1.3 ft. on bole
49	Brown cubical rot (P. schweinitzii)	4	No conks. Visible decay in the interior of the bole.
		5	No conks, No visible decay.

Special agents:

Code	Agent	Severity/Instructions
27	Other disease coded at Oc3	Inspect tree for specific disease agent. Code 27 always requires updating to another code. Update 27 to an agent code 40 thru 49 or 55 thru 58, set to 00, or code for another non-disease agent present. If coded other than 00, a severity rating is required for the new agent code.
50	Suppression *	No severity rating. Code this agent if tree is overtopped by other trees and will not live 10 more years, Or: will prevent a sapling from reaching 5.0 in. d.b.h.
51	Excessively deformed sapling *	No severity rating. Code this agent on live trees (1.0-4.9 in. d.b.h.) that will never produce a minimum log. A minimum log for conifers is 16.0 ft. long, and, for hardwoods, 8.0 ft. long.

52	Insects coded at Oc3	Inspect tree for specific insect agent. Code 52 always requires updating to another code. Update 52 to agent code 1 thru 25, set to 00, or code for another non-insect agent present. If other than 00, severity rating is required.

Foliar pathogens:

Code	Agent
55	General/other
56	Rhabdocline (only on Psme)
57	Elytroderma (only on Pipo)
58	Broom rusts (only on Abies and Picea spp.)
59	Swiss needle cast

Code	Severity
1	<20% of foliage affected, Or: <20% of crown in brooms.
2	≥20% of foliage affected, Or: >20% of crown in brooms.

Root diseases: (see Appendix Error! Reference source not found. **for identification of individual root disease symptoms)**

Code	Agent
60	General/other
61	Annosus root disease
62	Armillaria root disease
63	Black stain root disease
65	Laminated root rot
66	Port-Orford-cedar root disease

Code	Severity
1	Tree is a live tally tree within 30.0 ft. of a tree or stump that has a root disease to which the tally tree is susceptible. Enter the agent code
2	Live tally tree with signs or symptoms diagnostic for root disease such as characteristic decay, stain, ectotrophic mycelia, mycelial fans, conks or excessive resin flow at the root collar. No visible crown deterioration.
3	Live tally tree with signs or symptoms diagnostic for root disease such as characteristic decay, stain, ectotrophic mycelia, mycelial fans, conks, or excessive resin flow at the root collar. Visible crown deterioration such as thinning chlorotic foliage, reduced terminal growth, and/or stress cones.

Animal agents:

Code	Agent
70	Animal: general/unknown
71	Mountain beaver
72	Livestock
73	Deer or elk
74	Porcupines
75	Pocket gophers, squirrels, mice voles, rabbits, hares.
76	Beaver
77	Bear

Code	Severity
1	<20% of the crown is affected. Bole damage is restricted to less than half of circumference.
2	≥20% of the crown is affected. Bole damage to half or more of circumference.

Weather agents:

Code	Agent
80	Weather: general/unknown
81	Windthrow or wind breakage

Code	Severity
1	<20% of the crown is affected.

82	Snow/ice bending or breakage	2	≥20% of the crown is affected, Or: any damage to the bole.
83	Frost damage on shoots		
84	Winter desiccation		
85	Drought/moisture deficiency		

Other agents:

Code	Agent	Code	Severity
86	Sun scald	1	<20% of the crown affected.
87	Lightning		
90	Other: general/unknown	2	≥20% of the crown affected, Or: any damage to the bole.
91	Logging damage		
92	Fire: basal scars or scorch		
93	Improper planting		
94	Air pollution or other chemical damage		

Physical defects:

Code	Agent	Code	Severity
95	Unspecified physical defect	0	Severity is not rated
96	Broken, missing, or dead top *		
97	Forked top *		
98	Crooks		
99	Checks/bole cracks		

Code for physical defect only if Item 24, Cull Other is greater than "0". Only codes 96 and 97 are of much importance. Code 95, 98, and 98 only after any other agents present are coded.

***** denotes an agent automatically considered of highest importance. Code this agent first.

Item 32--Cause of death/Wildlife use or Reason for disappearance/Harvest use

This data element is used to code cause of death for mortality trees, wildlife use or reason for disappearance for snags, and harvest use for harvested trees.

1. **Mortality trees:** Tree history is 5. Record a 2-digit code to indicate the cause of death of a tree sampled or reconstructed as live and ≥1.0 in. d.b.h. or larger at Oc3. Use the same codes listed for Damaging Agent but do not use code 27, 51, or 52. If the mortality tree is also a snag (tree history 7) entered on a separate line, enter a Wildlife Use code for the snag record.

   Two causes of death may be coded. The primary cause is entered in Agent 2 and the secondary cause, in Agent 3.

   Cause of death is used to analyze tree mortality and calibrate mortality estimators.

   MQO: Cause classified in correct category, at least 75% of the time

2. **Snags:** Tree history is 7. A 1-digit code is required for all snags to indicate wildlife use or reason for disappearance. If a snag tallied at Oc3 is still qualifies as a snag at Oc4, code for use by wildlife; code "01" if a cavity or den is present, or "00" if there is no cavity or den. Snags still present also should be coded for Oc4 decay class in Item 34. If a snag tallied at Oc3 is now "gone" or no longer qualifies as a snag, code the reason for demise.

   Wildlife Use MQO: No errors, at least 90% of the time

   Reason For Disappearance MQO: No errors, at least 90% of the time

Code	Wildlife use or Reason for disappearance	
00	No cavity or den present.	SNAG PRESENT
01	Cavity or den present.	
02	Fell over "naturally" (wind, decay, etc.) or no longer self-supported; still present.	
03	Fell over "naturally;" removed from the site.	
04	Cut down or pushed over; still present.	SNAG "GONE"
05	Cut down or pushed over; removed from the site.	
06	D.b.h. and/or height no longer meet minimum for tally (snag "shrank" to less than 5.0 in. d.b.h. or less than 4.5 feet tall).	
10	No cavity or den present.	SNAG GREW "IN" AND DIED
11	Cavity or den present.	

3. **Harvested trees:** Tree history is 8. Record a 2-digit code for trees tallied or reconstructed as live and ≥5.0 in. d.b.h. at Oc3 that are now harvested.

Code	Harvest use
01	Harvested for industrial supply
02	Harvested for firewood or local use
03	Harvested for incidental reasons

Harvest Use MQO: No errors, at least 90% of the time

Definitions of harvest use:

Harvested for industrial supply means the tree was harvested for industrial roundwood or chips. The tree was not used for firewood or for products manufactured and used by "do-it-yourselfers", often on the property of origin for improvements such as fences, buildings and bridges. The tree was marketed and transported from the property of origin to wood-using plant or export operation.

Harvested for firewood or local use means the tree was harvested for firewood, or for wood products manufactured and used locally by "do-it-yourselfers", often on the ownership of origin, for improvements such as fences, buildings and bridges. The tree was not marketed and transported to a wood-processing plant or export operation.

Harvested for incidental reasons means the tree was harvested (1) as an isolated removal in an otherwise undisturbed stand or (2) as part of a harvest activity in an adjacent stand condition that resulted in the removal of one or more tally trees.

Item 33--Oc3 snag decay class

A 1-digit code downloaded/printed for snags sampled at Oc3. If still a snag ≥5.0 in. d.b.h. and ≥4.5 feet tall and has a bole which does not touch the ground, revise Oc3 decay class if obviously incorrect. Do not reconstruct for snags sampled for the first time at Oc4. Decay classes are listed in the next item.

Item 34--*Oc4* SNAG DECAY CLASS

Record for each standing dead tree, 5.0-inch in diameter and larger, indicating the trees stage of decay.

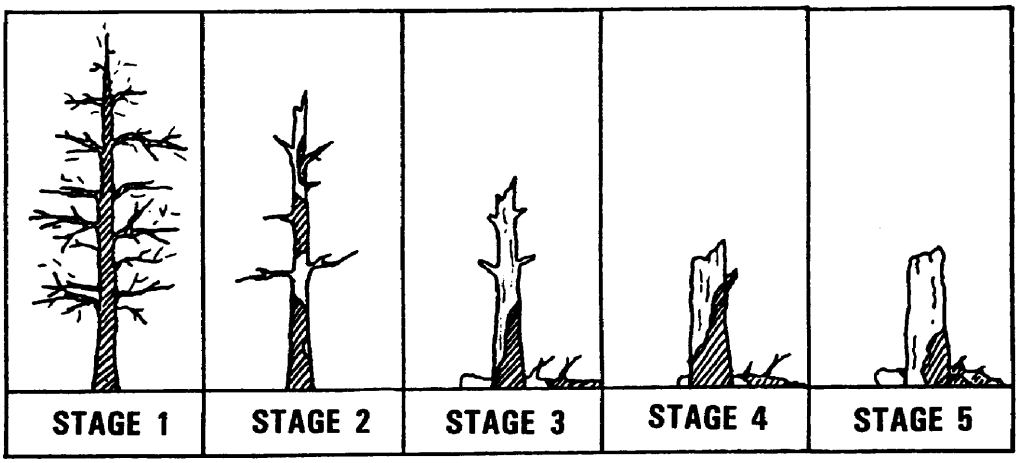
It is unlikely that decay class 5 will apply to snags; by the time a snag has reached decay class 5, it will have toppled over or have become too short to qualify as a snag.

When Collected: All standing dead tally trees ≥ 5.0 in d.b.h.
Field width: 1 digit
MQO: ±1 class, at least 90% of the time.
Values: Use the following table for guidelines:

Characteristics of Douglas-fir snags by decay class[1]

Snag characteristics						
Decay Stage (code)	**Limbs and Branches**	**Top**	**% Bark Remaining**	**Sapwood Presence**	**Sapwood Condition**	**Heartwood Condition**
1	All present	Pointed	100	Intact	Sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	Broken	Variable	Sloughing	Advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs	Broken	Variable	Sloughing	Fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing	Cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

[1] Characteristics are for Douglas-fir. Snags for other species may vary somewhat; use this table as a guide.



Item 35--TREE NOTES

Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All live and dead tally trees ≥ 1.0 in d.b.h.
Field width: Alphanumeric character field
MQO: N/A
Values: English language words, phrases and numbers

Tree record comments

Use the following codes to record comments pertaining to a tree record.

Guide to Husky tree record comment codes:

Comment	Code
Basal scar	1
Extrapolated age	2
Half diam method	3
Stump	4
D-nail not found	5
Leaning tree	6
Topout; dead top	7
Forked top	8
Crook or sweep	9

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XI. COARSE WOODY DEBRIS

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XI. COARSE WOODY DEBRIS

A. Introduction
Coarse woody debris (CWD) is dead, downed pieces of wood. CWD, like live trees, snags, stumps, nontree vegetation and litter, is a component of vegetative structural diversity. Wildlife biologists, mycologists, ecologists, foresters and others are interested in CWD because it relates to:

- wildlife habitats
- vegetation diversity
- storage and cycling of nutrients and water
- carbon sequestration, which relates to atmospheric conditions
- fire behavior

Knowledge about the nature and function of CWD is incomplete. Most studies have been conducted in mature and old-growth forests that originated naturally after fire. Little is known about the characteristics of woody debris in managed forest stands and in stands that originated after logging: stands that are present on most of the forest, especially the non-Federally-owned forests, that PNW-FIA inventories in Washington, Oregon and California.

B. Definition of coarse woody debris
In this inventory, CWD includes downed, dead tree and shrub boles, limbs, and other woody pieces that are severed from their original source of growth or are uprooted (no longer self-supported by their roots). It also includes other non-machine processed roundwood such as fence posts and cabin logs.
CWD does not include:

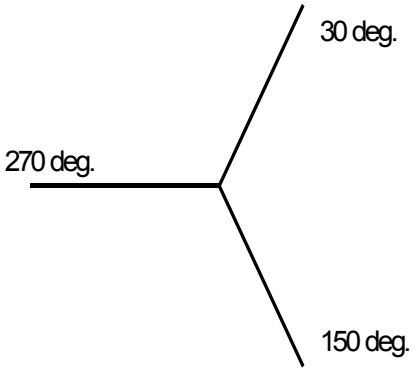
1. Standing dead trees or shrubs self-supported by their roots.
2. Trees showing any sign of life.
3. Stumps that are rooted in the ground (i.e. not uprooted).
4. Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
5. Roots or main bole below the root collar.

C. Sampling methods
Two sampling methods are used to sample CWD. Normally, line intersect sampling is used. In this method, transects are established, and downed pieces meeting specified dimensions and criteria are selected if their central axis is intersected by the transect. Special procedures apply when the piece lays across a condition class boundary.

The line intersect method is not practical for sampling CWD pieces that are part of machine-piled slash piles or windrows, or that are part of log "jumbles" at the bottom of steep-sided ravines in which individual pieces are absolutely impossible to tally separately. In these cases, piled are sampled (on the entire 55.8 ft. fixed-radius plot) according to instructions titled "Sampling residue piles" on page 140.

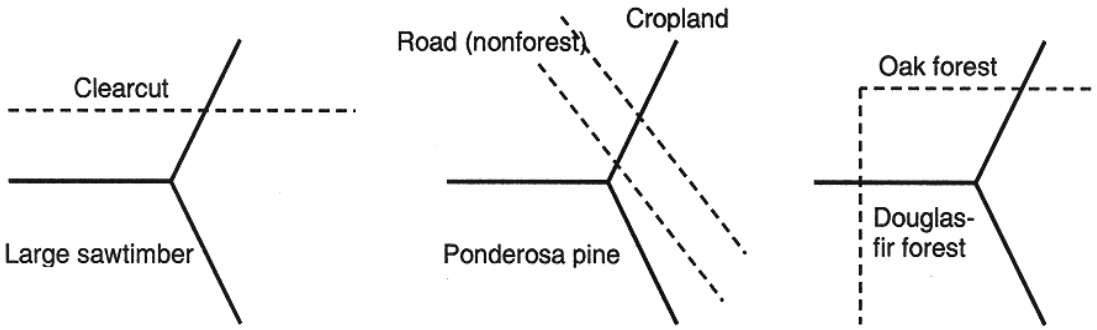
D. Locating and establishing line transects
Three transects are established on all established (##) subplots if the subplot center is accessible (i.e. the subplot center is not Census water, access denied, or hazardous) and the condition class at the subplot center is classified as accessible forest land (Condition Status = 1).

Each transect originates at the subplot center and extends 55.8-feet horizontal distance. The azimuths from subplot center to the end of the three transects are, respectively, 30, 150, and 270 degrees. It is extremely important to lay out the transect in a straight line to avoid biasing the selection of pieces and to allow the remeasurement of transect lines and tally pieces for change. The transects also may be used to sample overstory tree cover.



Line transect layout on a subplot

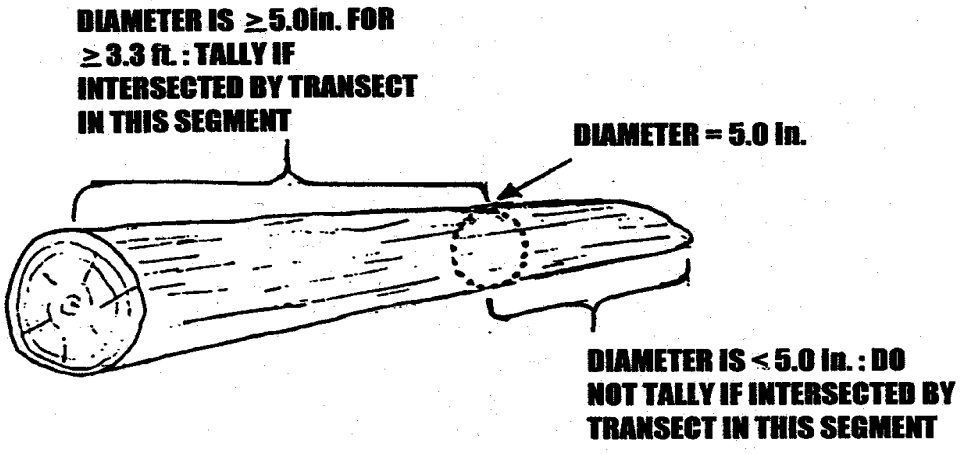
On subplots where a transect intersects a boundary between condition classes, the transect continues across the boundary into the adjacent class. Individual pieces of CWD intersected by a transect are tallied if they meet the tally rules specified in the next two sections (E and F).



E. Tally rules for coarse woody debris

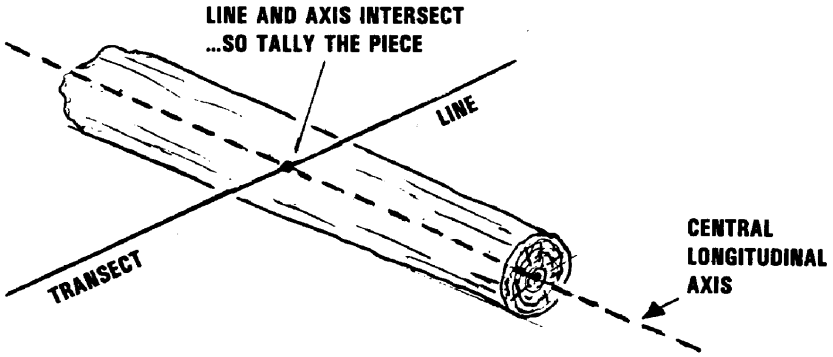
1. Tally a piece only if it is at least 5.0 in. in diameter at the point of intersection with the transect plane.

2. Tally a piece only if it is at least 3.3 feet in length and 5.0 in. or more in diameter along that length (in decay class 1-4). Measure length to the nearest 0.1 ft. to determine if ≥3.3 ft. See diagram below.



3. Tally a piece only if 1) the intersection of the piece with the transect plane, **and** 2) the midpoint of the piece's length between small and large end diameters (Items 6 and 7 on page 136) are in condition class 1. If this condition class is not accessible forest land, do not tally the piece.

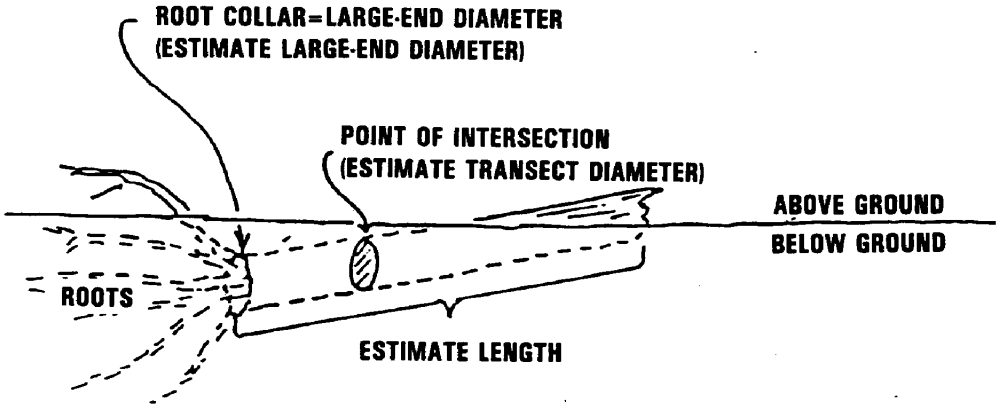
4. Tally a piece only if its central longitudinal axis is intersected by the transect plane.



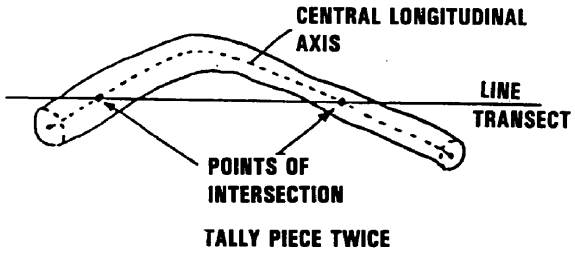
5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine-piled. Do not record pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" at the bottom of a steep-sided ravine in which individual pieces are absolutely impossible to tally separately. Instead, sample these piles according to instructions on "Sampling residue piles" (see page 140). A slash pile or windrow consists of broken logs, limbs, and other vegetative debris.

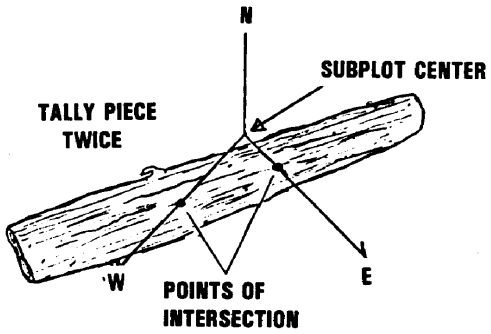
6. Tally only those portions of pieces that are decay class 1, 2, 3, or 4. Do not tally pieces or segments of pieces that are decay class 5. Pieces in decay class 5 are not tallied due to the difficulty in defining pieces in this category (the entire ground surface in some areas seems to be decay class 5 material) and the subjectivity in measuring them. If a piece has segments that are decay classes 1, 2, 3, or 4 and decay class 5, consider the decay class 5 segment a break in the piece and treat as two separate pieces.

7. Tally a piece regardless of whether the point of intersection occurs on or above the ground, or is buried in the litter, duff, or mineral soil. The only restriction on tallying buried pieces are (1) that the piece must be visible somewhere on or above the ground and (2) that it meets all other criteria for tally.



8. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected.





9. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece. Tally the piece on the north transect. Record the CWD Distance as 001.

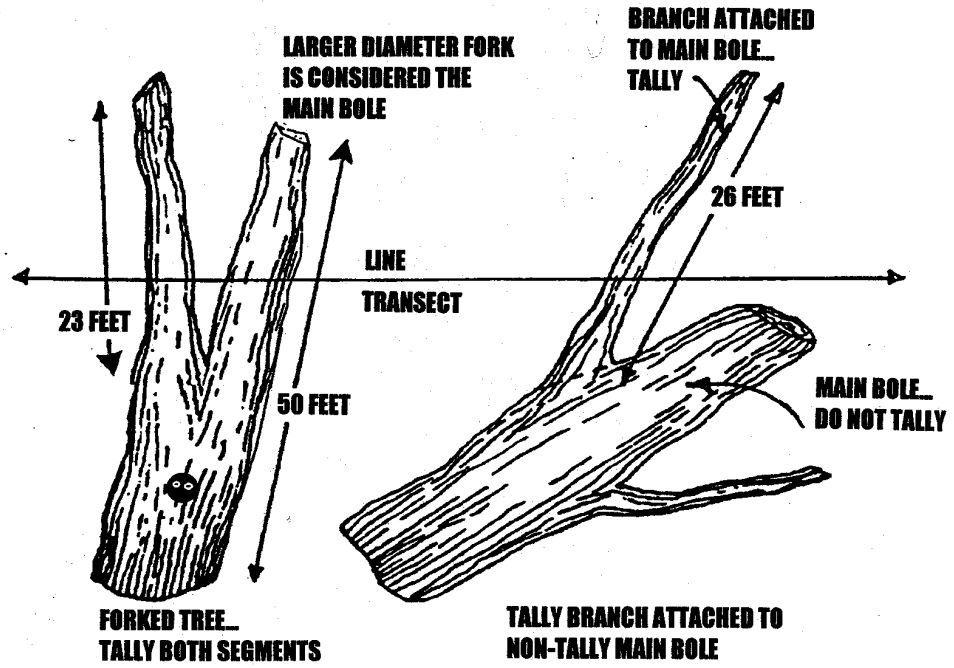
10. If a piece is fractured across its diameter, and would pull apart at the fracture if pulled from either end, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

11. If a piece is split along its length, would pull apart at the split if pulled from either side, and the split was due to the piece falling or to the impact of another piece or object, then treat it as two separate pieces. If judged that it would not pull apart , tally as one piece. Tally only pieces intersected by the transect line.

12. Tally dead, uprooted trees, snags, and stumps that are no longer supported by their roots from falling over. Do not tally live trees, dead trees, snags or stumps that are leaning, but still supported by their roots from falling over. The crew's judgment on whether or not a tree, snag or stump is self-supported by its roots is final.

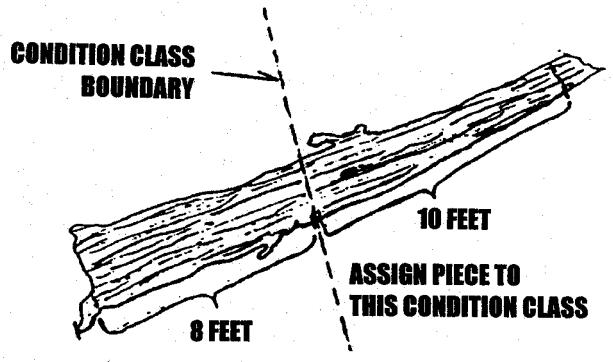
13. Do not tally a piece if the transect intersects the piece on the root side of the root collar. Do not tally roots.

14. When the transect crosses forks, branches or boles of one tree (i.e. two or more pieces that are connected), tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements. In the case of forked trees, consider the "main bole" to be the piece with the largest diameter at the fork. Characteristics for this fork such as length and decay class should pertain to the entire main bole. For smaller forks, or branches connected to a main bole (even if the main bole is not a tally piece) characteristics pertain only to that portion of the piece up to the point where it attaches to the main bole.

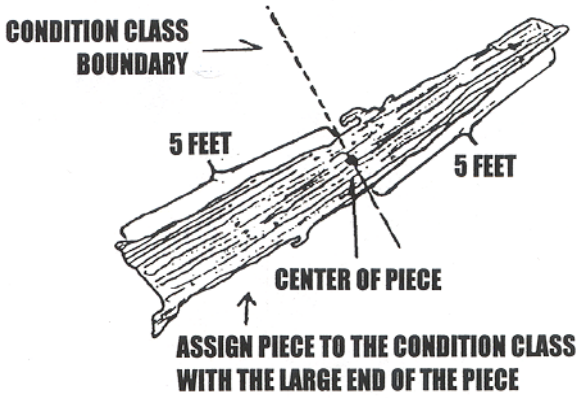


F. Tally rules for CWD when the piece lays across two or more condition classes

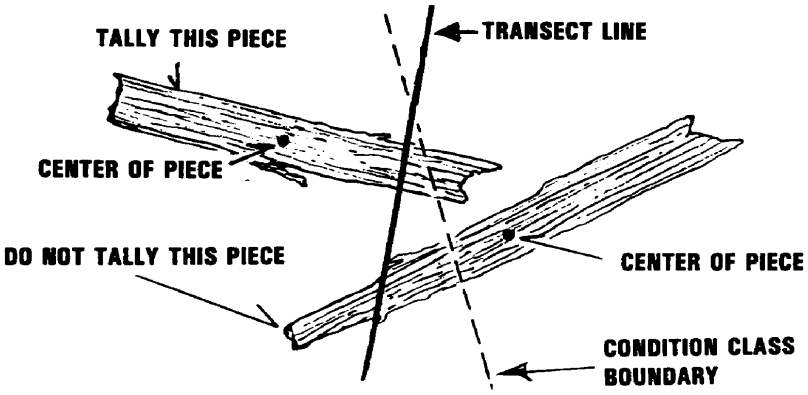
1. A piece is assigned to the condition class that contains the midpoint of the piece's length between small and large end diameters (Item 6 and 7 on page 136). Do not tally the piece if its midpoint is in a condition class other than condition class 1.



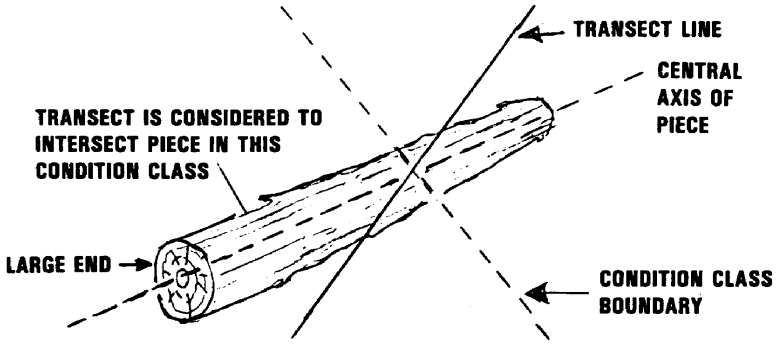
2. If the condition class boundary crosses a piece exactly at the midpoint of the piece's length between small and large end diameters (Item 6 and 7), assign the piece to the condition class that contains the large end of the piece; if its large end is in a condition class other than condition class 1.



3. Tally a piece only if the transect plane intersects the piece in the condition class to which the piece is assigned. (The midpoint of the piece's length between small and large end diameter (Items 6 and 7) and the point of intersection must both be within the same condition class for the piece to be tallied). Do not tally a piece if its intersection with the transect is in a condition class other than condition class 1.



4. If a transect intersects a piece on a condition class boundary, the transect will be considered to intersect the piece in the condition class which contains the large end of the piece. Do not tally a piece if its intersection with the transect is in a condition class other than condition class 1.



G. Marking CWD

If, at the point of intersection, a qualifying piece is decay class 1, 2, or 3, mark the point of intersection on the piece with a nail. Position the nail on top of the piece at the point of intersection with the transect. If possible, drive the nail into the piece so that only about 1 inch of the nail is left exposed. Stop driving the nail if the next blow means breaking the piece or seriously disturbing the location of the piece.

H. Recording procedures

Record each piece on a transect as a single line entry, completing the items indicated with "X"s on the CWD tally guide. If no CWD pieces are tallied on a transect, enter a line of data with subplot number (SUB PL), transect (T), and "000" for species (SPC).

CWD TALLY GUIDE

	SUB PL	T	CWD DIST	SPC	TRAN DIAM	SML DIAM	LRG DIAM	TOTAL LENGTH	COND LENGTH	DECAY CLASS	# of CONT	ORNT	HOL?
Item #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
			(ft)		(in)	(in)	(in)	(ft)	(ft)				
	XX	XXX	XX.Y	XXX	XXX	XXX	XXX	XX	XX	X	XX	X	X

I. Individual data items for CWD pieces

Item 1--Subplot number (SUB PL)

Record a 2-digit code indicating the subplot center from which the transect originates. Use the procedures described on page 33.

Item 2--Transect (T)

Record a 3-digit code indicating the transect on which the piece is sampled.

MQO: No errors, 100% of the time
Values:

Code	Definition
030	Transect extends 30 degrees from subplot center
150	Transect extends 150 degrees from subplot center
270	Transect extends 270 degrees from subplot center

Item 3--CWD slope distance (CWD DIST)

Record a 3-digit code indicating the slope distance from the subplot center to the point where the transect intersects the longitudinal center of the piece. Measure and record to the nearest 0.1 feet. CWD slope distance will be used in locate the piece for remeasurement in future inventories. If two or more pieces have the same slope distances, record the top piece first.

MQO: +/- 1.0 ft., at least 90% of the time
Values: 0.1 to 99.9

Item 4--Species (SPC)

Record a 3-digit code indicating the species of the piece. Species codes are the same as those used for trackable trees (see page 99).

Species identification may be uncertain for some pieces. Make an educated guess. The piece's bark (either attached or sloughed and laying beside the piece), branching pattern (if the branches are still present), or heartwood smell (particularly if cedars, Douglas-fir, or western hemlock) may provide clues. Observe the tree species currently on the site. On remeasurement plots, see what tree species were tallied in past inventories. One way to distinguish hardwoods from conifer is through the type of decay present. Hardwoods usually have a white or grayish stringy rot, while conifers usually have a reddish-brown blocky rot. An educated guess, even an incorrect species, is preferable to using the unknown species code (999) if the guess correctly identifies the piece as a conifer or hardwood.

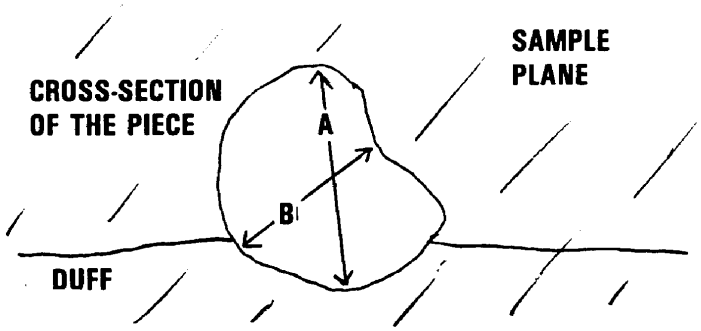
MQO: No errors, at least 80% of the time (when reasonable)

Item 5--Diameter at point of intersection (TRAN DIAM)

Record a 3-digit code indicating the piece's diameter at the point where the transect intersects the longitudinal center of the piece. The diameter is recorded to the nearest inch. Measurement is required when the diameter is within 1 inch of 5.0 in.

MQO: Pieces with decay class 1, 2, or 3: +/- 1.0 in., at least 90% of the time
Pieces with decay class 4: +/- 2.0 in., at least 90% of the time
Values: 5 to 999

TRAN DIAM is the piece's diameter, not the length of the transect over the piece, for pieces that are not round in cross-section because of missing chunks of wood or due to "settling" due to decay, measure the diameter if possible. If not possible, estimate the longest and shortest axis of the cross-section ("A" and "B" in the diagram below). Record the average of these two estimates as the diameter. This technique applies to transect, small-end, and large-end diameters.



Item 6--Diameter at the small end (SML DIAM)

Record a 3-digit code indicating the diameter at the piece's small end. The diameter is recorded to the nearest inch. The small end diameter occurs either at 1) the small diameter end of the piece if the small diameter end is $\geq$ 5.0 in. or 2) at the point where the piece tapers down to 5.0 in. in diameter. Use the same measurement procedures used for Item 5.

MQO: +/- 2.0 in., at least 90% of the time

Item 7--Diameter at the large end (LRG DIAM)

Record a 3-digit code indicating the diameter at the piece's large end. The diameter is recorded to the nearest inch. The large end will occur either at a broken or sawn end, at a fracture, or at the root collar. Use the same procedures used for Item 6.

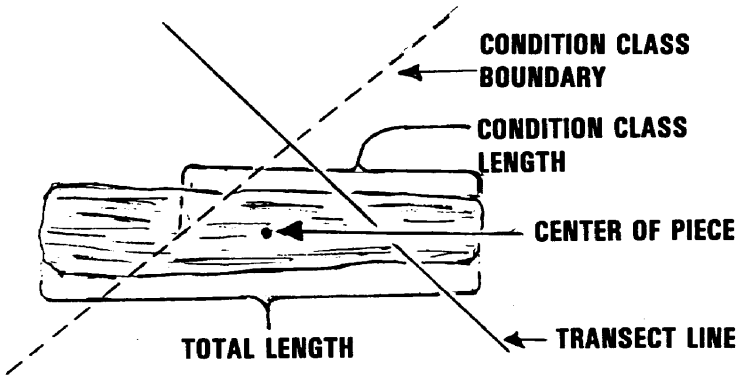
Item 8--Total length (TOTAL LENGTH)

Record a 3-digit code indicating the total length of the piece to the nearest foot. Total length is the length of the piece that lies between the piece's recorded small and large end diameters (Items 6 & 7).

MQO: +/- 10%, at least 90% of the time
Values: 3 to 300

Item 9--Condition class length (COND LENGTH)

Record a 3-digit code indicating the length of the portion of the piece's recorded total length (Item 8) that lies within the condition class to which the piece is assigned. Record to the nearest foot. When total length is entirely in one condition class, condition class length and total length are the same.



MQO: +/- 10%, at least 90% of the time
Values: 3 to 300

Item 10--Decay class (DECAY CLASS)

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the recorded total length (Item 8) of the piece. Do not tally decay class 5 pieces. When tallying a piece, the sampled portion ends where the decay class 5 begins. Use the guide below (which differ from the decay class descriptions for snags) to determine decay class for CWD.

MQO: +/- 1 class, at least 90% of the time
Values:

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound	Intact, no rot; conks of stem decay conks absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports its own weight	Hard, large pieces; sapwood can be pulled apart by hand	Reddish-brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten; piece does not support its own weight, but maintains its shape	Soft, small blocky pieces; metal pin can be pushed into heartwood	Reddish or light brown	Throughout	Branch stubs pull out
5	None, piece no longer maintains its shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Throughout	Branch stubs and pitch pockets have usually rotted down

Item 11--Number of other pieces contacted (# CONT)

Record a 2-digit code indicating the number of other pieces in actual physical contact with the tallied piece. These contacts can be in condition classes other than the condition class to which the tally piece is assigned. Count only those pieces in contact with the segment of the tallied piece defined by the recorded total length (Item 8). Count only those pieces that would qualify as tally pieces (≥ 3 feet long, 5.0 in. minimum diameter along the length, and decay class 1, 2, 3, or 4).

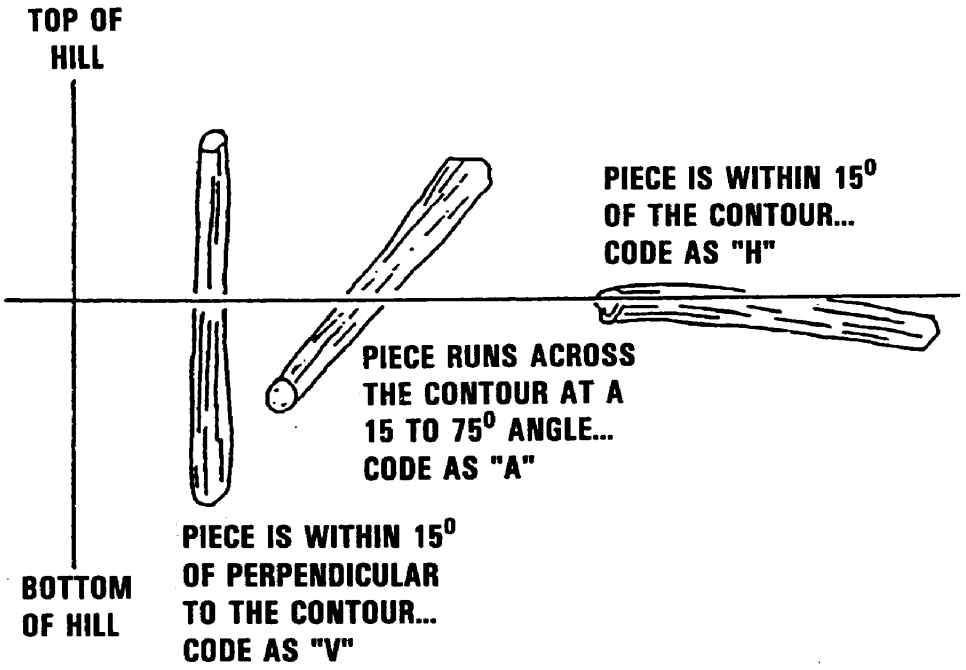
MQO: +/- 1, at least 90% of the time
Values: 1 to 50

Item 12--Orientation on slope (ORNT)

Record a 1-digit code indicating the orientation of the piece on the slope. If the piece is suspended above the ground, select the code which best estimates the orientation if the piece were on the ground.

MQO: No errors, at least 90% of the time
Values:

Code	Orientation	Definition
H	Horizontal	Piece is oriented within 15 degrees of the contour.
V	Vertical	Piece is oriented within 15 degrees of perpendicular to the contour.
A	Across	Piece is oriented between vertical and horizontal.
F	Flat	Piece is on flat ground (≤10% slope).



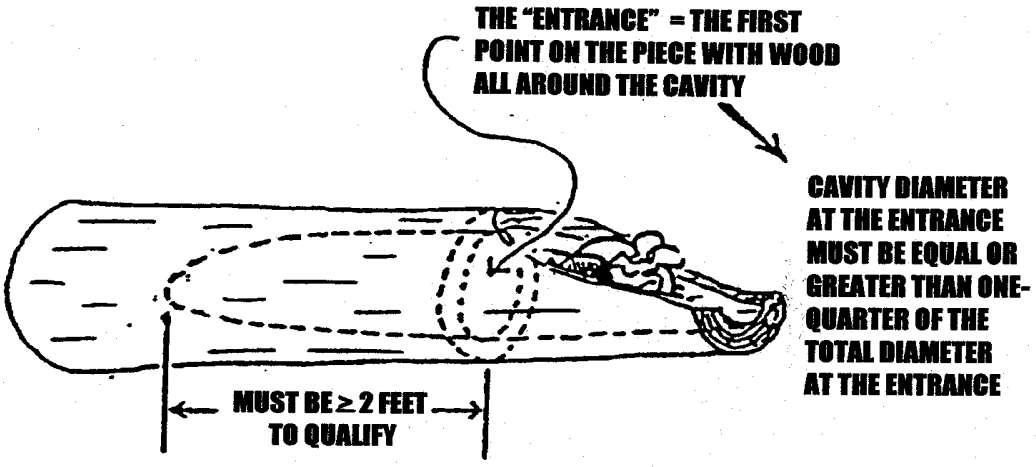
Item 13--Is the piece hollow? (HOL?)

Record a 1-digit code indicating whether the piece is hollow.

MQO: No errors, at least 95% of the time
Values:

Code	Definition
Y	A piece is considered hollow if a cavity extends at least 2 feet along the central longitudinal axis of the piece, and the diameter of the entrance to the cavity is at least 1/4 of the diameter of the piece where the entrance occurs. The entrance occurs at the point where the

	circumference of the cavity is whole -- the point where wood is present completely around the circumference of the cavity. The length of the cavity begins at this point
N	Does not meet criteria for hollow



J. Transect line segmenting

Established transect lines are segmented to determine the proportion of transect length that occurs within each mapped condition intersecting the line.

Starting at the subplot center and working towards the fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record. If only one condition class occurs on the transect line only one segment is recorded.

Individual data items

TRANSECT SEGMENTING TALLY GUIDE

	SUB PL	T	C	SLOPE DIST1	SLOPE DIST2	SLP PCT	HOR DIST
ITEM #	**1**	**2**	**3**	**4**	**5**	**6**	**7**
				(ft)	(ft)		(ft)
	XX	XXX	X	XX.Y	XX.Y	XX	XX.Y aa.a bb.b

calculated by Husky:

aa.a = sum of all horizontal distances for a transect

bb.b = slope distance along the transect which is equivalent to 24.0 ft horizontal distance

Item 1--Subplot number (SUB PL)

Record a 2-digit code indicating the subplot center from which the transect originates. Use the procedures described on page 33.

Item 2--Transect (T)

Record a 3-digit code indicating the transect on which a condition class is being delineated. Use the same procedures and codes used for CWD piece tally on page 135.

Item 3--Condition class (C)

Record a 1-digit code indicating the number of the condition class of the transect segment. Use the same code used for CONDITION CLASS NUMBER on page 47. The first segmentation record for each transect will have the same Condition Class Number as assigned to the subplot center.

MQO: No errors, 100% of the time

Item 4--Beginning Distance (DIST1)

A 3-digit code. Record the slope distance along the transect line where the transect intersects the boundary with the adjacent condition class nearer to the subplot center. The first record for each transect will have a Beginning Distance of 0.0 ft.. Each subsequent record will have a Beginning Distance equal to the Ending Distance of the previous record.

MQO: +/- 1.0 ft., at least 95% of the time
Values: 0 to 99.9

Item 5--Ending distance (DIST2)

A 4-digit code. Record the slope distance along the transect line where the transect exits the condition class segment being delineated and intersects the boundary with a condition class further away from the subplot center. If no other condition classes are encountered record the slope distance on the transect line to the edge of the fixed radius plot.

MQO: +/- 1.0 ft., at least 95% of the time
Values: 0.1 to 99.9

Item 6--Slope percent (SLP PCT)

Record a 3-digit code indicating the average slope percent along the transect within the condition class being segmented. When only one condition class is present on a transect, slope percent is the average slope percent along the entire transect. Measure to the nearest 5%.

MQO: +/- 10%, at least 90% of the time
Values: 5 to 155

Item 7--Horizontal distance (HOR DIST)

The Husky data recorder will use the Beginning Distance, Ending Distance, and Slope Percent of each delineated segment to calculate the Horizontal Distance of the segment along the transect line.

A check on recorded segment lengths and slope and percents:

For each transect, the Husky program will compute the combined horizontal distance of all the segments along the transect. The Husky will inform you if the total computed horizontal distance is more or less than 55.8 feet and by how much. Adjust the recorded slope percents, or the Ending Distance of the last segment, until the total computed horizontal distance is 55.8 feet. If recording on paper, do this adjustment manually with a calculator.

The Husky program will also compute and display the slope distance along the transect which is equivalent to 24.0 ft horizontal distance. This slope distance is needed as a part of overstory Tree Cover sampling.

K. Sampling residue piles

The line transect method is not practical when sampling CWD within piles and windrows. Piles and windrows will be sampled on the 55.8-foot fixed-radius plot of subplots established on the standard layout. Sample piles and windrows regardless of whether they are intersected by a transect.

Piles and windrows created directly by human activity and log piles at the bottom of steep-sided ravines in which individual pieces are absolutely impossible to tally separately are candidates for sampling using the following instructions. CWD in piles created by windthrow, landslides, fires, and other natural causes should be tallied using line transects unless it would be physically impossible to measure the pieces in the natural pile.

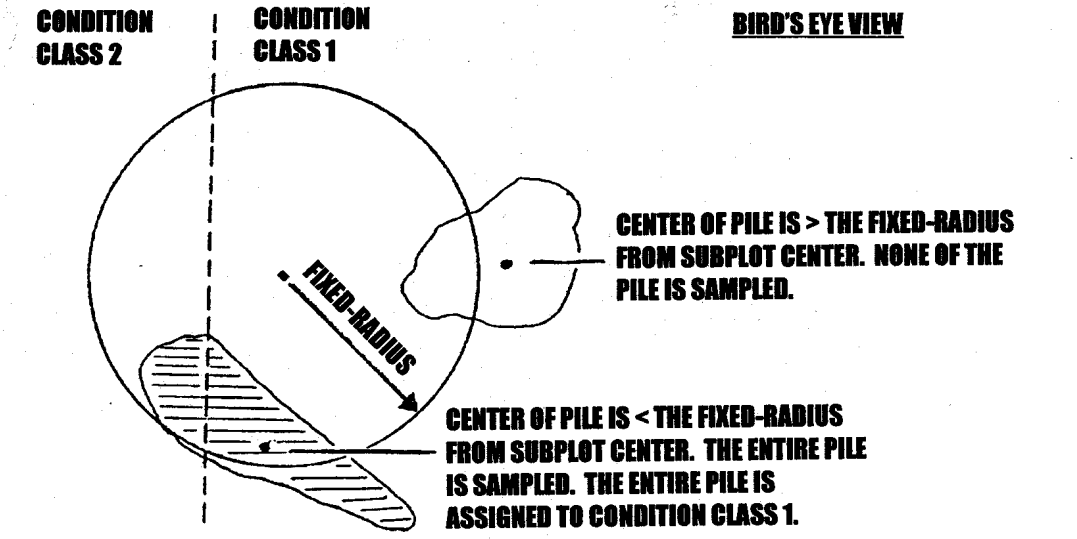
Selection instructions
For a pile to be tallied, **all** of the following criteria must be met;

- The pile's center must be within 55.8 horizontal feet of subplot center,
- the pile's center must be in condition class 1, and
- the subplot center must be accessible (not Census water, denied access or hazardous), and
- more than 50% of the pieces meet the size and length criteria used for tallying individual pieces (see Section E--"Tally rules for coarse woody debris" on page 130)

The pile is assigned to the condition class in which pile center lies.
Apply the following steps to determine the center of a pile or windrow:

1. Determine the longest axis of a pile.
2. Determine the midpoint of this axis.
3. Project a line through this midpoint that is perpendicular to the axis determined in step 1.
4. Determine the midpoint of the segment of this projected line that crosses the pile.

Piles that cross the 55.8-foot fixed-radius plot boundary: If the center of a pile is within 55.8 horizontal feet of subplot center, tally the pile, recording the dimensions of the entire pile even if part of the pile is beyond 55.8 feet. If the center of a pile is more than 55.8 horizontal feet of subplot center, do not tally the pile or any portion of the pile.



Recording procedures
Record each residue pile on a subplot as a single line entry, completing the items indicated with "X"s on the Pile tally guide. If no Piles are tallied on a subplot, enter a line of data with subplot number (SUB PL) and "000" for Pile azimuth (PILE AZM).

Individual data items

PILE TALLY GUIDE

	SUB PL	CC	PILE AZM	SHP	LNG1	LNG2	WID1	WID2	HT1	HT2
ITEM #	1	2	3	4	5	6	7	8	9	10
					(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
	XX	X	XXX	X	XX	XX	XX	XX	XX	XX

Item 1--Subplot number (SUB PL)

Record a 2-digit code indicating the subplot number. Use the procedures described on page 33.

When collected: All sampled residue piles
MQO: +/- 10, at least 90% of the time

Item 2--Condition class (CC)

Record a 1-digit code indicating the number of the condition class to which the pile is assigned. Use the same code used for CONDITION CLASS NUMBER on page 47.

When collected: All sampled residue piles
MQO: No errors, 100% of the time

Item 3--Pile azimuth (PILE AZM)

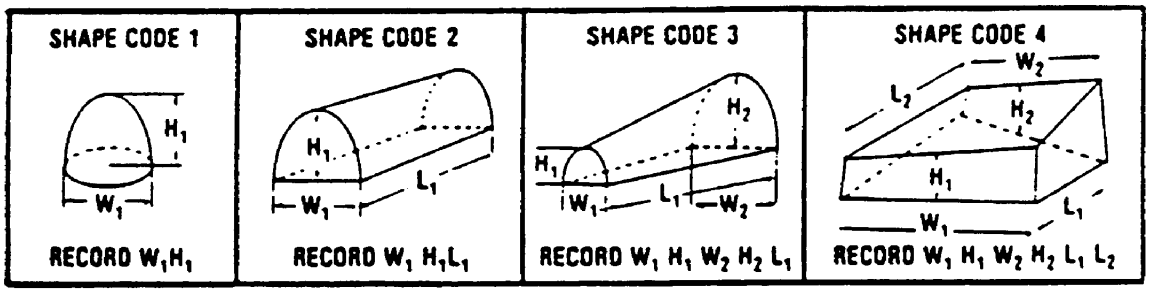
Record a 3-digit code indicating the azimuth from the subplot center to the pile. This azimuth centers on the pile so that it can be relocated. Record 000 for subplots on which no piles are tallied.

When collected: All sampled residue piles
MQO: +/- 10, at least 90% of the time
Values: 000, 1 to 360

Item 4--Shape (SHP)

Record a 1-digit code indicating the shape of the pile. Determine which of the 4 shapes diagrammed below most resembles the pile and record the dimensions. Pile dimensions should be ocularly smoothed out when making estimates. Average the unevenness of protruding pieces.

When collected: When Item 3 is $\geq$0
MQO: No errors, at least 90% of the time
Values:



Items 5 and 6--Length 1 and Length 2 (LNG1, LNG2)

Record a 2-digit code indicating the length of the sides of the pile. Estimate to the nearest foot. Length 1 may often equal Length 2.

When collected: See Item 4
MQO: +/- 10%, at least 90% of the time
Values: 1 to 99

Items 7 and 8--Width 1 and Width 2 (WID1, WID2)

Record a 2-digit code indicating the width of the sides of the pile. Estimate to the nearest foot. Width 1 may often equal Width 2.

When collected: See Item 4
MQO: +/- 10%, at least 90% of the time
Values: 1 to 99

Items 9 and 10--Height 1 and Height 2 (HT1, HT2)

Record a 2-digit code indicating the height of either end of the pile. Estimate to the nearest foot. Height 1 may often equal Height 2.

When collected: See Item 4
MQO: +/- 10%, at least 90% of the time
Values: 1 to 99

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XII. COORDINATES (GPS)

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XII. COORDINATES (GPS)

A. Overview
An objective of the inventory is to obtain accurate coordinates for each field grid location. Coordinates are used to correlate plot information with remotely sensed imagery and data and in relocating the plot at future inventories. On each visited plot, coordinates are collected using GPS recorders when possible. GPS stands for Global Positioning System, a technology that uses signals from satellites to triangulate and compute the coordinates of locations on the ground. In collecting GPS coordinates PNW-FIA uses the Rockwell PLGR military receivers. PLGR stands for Precision Lightweight GPS Receiver.

This chapter is written so that the first 7 Sections (A-G) and the final Section (K), are essential for plot coordinate collection. The other Sections (H-J) demonstrate some of the more advanced features of the PLGR. Although these advanced features are not entirely necessary for plot work, they can be of much value and save a lot of time if used properly. The procedures are written in a simple, step by step fashion (which makes them appear lengthy at first glance). But after using the PLGR a few times, a person will be able to maneuver through the various menus with relative ease and confidence.

B. When and where to collect readings
For each plot visited, attempt to collect a GPS file that has at least 180 satellite readings. Always start GPS procedures on a plot by trying to collect an adequate set of readings at the center of subplot 1 on the standard layout; the objective is to obtain coordinates at this subplot center, the field grid location. A good plan is to try to collect an adequate set of readings as soon as the center of subplot 1 is located, and, if unsuccessful, to try again shortly before going to the next subplot. **Success** is GPS-generated coordinates for the field grid location (subplot 1) that are based on 180 or more readings.

If unsuccessful at the field grid location, use the instructions on page 27 to try to obtain coordinates at a different location. **NOTE:** Allow at least 45 min to an hour between readings to allow for different or new satellites to come into clear view of the receiver. If more than one coordinate is collected, record the coordinate that is closest to subplot 1 center and has at least 180 readings. Write any other collected GPS coordinates or any notes regarding GPS use on the front of the plot card.

C. Recording GPS information
GPS information is recorded in the Husky field data recorder (See the GPS COORDINATES section on page 27). When using the PLGR, record the Unit Number of the machine, UTM zone number, the **Easting** and **Northing** (**X** and **Y**) coordinates, the number of readings that were averaged, the error statistic (the error displayed while the machine was averaging readings), and the elevation of the reading, and the other items listed.

D. PLGR keypad layout and commands
The PLGR is a PPS (Precise Positioning Service) receiver. This means that it can read the encoded information from the satellites that contains the corrections to remove the intentionally introduced errors. Thus, the coordinates that it computes, do not have to be differentially corrected.

WARNING: Do not remove the memory battery located in the bottom of PLGR as this will erase the CRYPTO key which allows the unit to decode the introduced selective availability (SA) errors. If this key is erased the unit will need to be returned to the manufacturer for service and repair. See further instructions in Section K. Batteries.

PLGR keypad commands

LEFT/RIGHT arrow keys move the cursor between fields (by showing it blinking) and identify changeable fields.

UP/DOWN arrow keys make selections, scroll through menu pages (when the up/down arrows appear in the lower right hand corner), and change the contents of a field when it is currently blinking.

NUM LOCK key toggles the mode of the keypad: control or numeric. The PLGR is in Numeric mode when **N** (versus a **P**) is visible in the lower right hand corner of screen.

Off key: Push once and PLGR will shut off in 30 seconds, push twice fast and unit will shut off immediately.

On-line help: MENU key, HELP option or press LEFT/RIGHT arrow keys at the same time.

Keypad map: press ON/BRT key and MENU key at the same time.

Short cut from **CONT** mode to **AVG** mode: Push and hold POS key for about 4-5 seconds and then release.

Initiate screen backlight: ON/BRT key

Adjust screen backlight: ON/BRT key plus up/down arrow for rapid change.

E. PLGR setup options
Listed below are the parameters to be setup before collecting satellite readings. Once these parameters are set up for the first time they will not need to be reset. Periodically (at least weekly) the unit should be checked to see that the settings have not been inadvertently changed.

IMPORTANT: Make sure that the DATUM being used is the North American Continental US of 1927 (Clarke 1866). This is set on the SETUP DTM page. Using a different datum will alter the coordinates significantly.

Press MENU key, use left or right arrow to select (blinking) **SETUP** option, then press either up or down arrow to enter the SETUP pages. To scroll through the following pages use the up/down arrows. To edit a field shown on a particular SETUP page push the right or left arrow until that field is blinking. To return to page scrolling, push the left or right arrow until the small up/down arrows appear in the bottom right corner (next to the P), then push the up or down arrows to view other SETUP pages.

Required data for SETUP pages

SETUP MODE
CONT for continuous tracking of satellites. **NOTE:** This mode has to be set each time the PLGR unit is turned on to collect a coordinate, unless the POS screen already shows **CONT** mode in use when the unit is turned on.
Once the error has gone down to +/-50ft, switch to **AVG** mode.
SV-Type: **mixed**

SETUP UNITS
Select the **UTM/UPS** datum.
Select **English** Units.
Elev: **feet**.
MSL for mean sea level, as opposed to DTM or height above ellipsoid datum.
ANG: **Deg** for degrees.
Select **True** for True North. Other options are Mag for magnetic north. **NOTE:** On some plots in California which were originally installed by phase 3 (FHM), magnetic north is used (declination is not set on the compass). See Item 5--DECLINATION on page 24. If declination is 0, use the MAG setting in PLGR.

SETUP MAGVAR (or MAG for old units)
TYPE: **Calc deg** (or **Calc** for old units) for calculated magnetic variation. Computes declination.

SETUP WAGE
WAGE: **on** (Wide Area GPS Enhancement) Always should be on
ELHold: **automatic**
Pacific Standard Time computed from Greenwich Mean time.

TIME: Loc = **Z - 0800** for Daylight savings time, or
Loc = **Z - 0700** for normal time.
ERR: **EHE + - ft2D** (or **+/- ft** for old units) Sets the error display in distance units, instead of FOM (figure of merit) codes.

SETUP DTM
DTM: **NAS-C** (No Amer-CONUS) Datum which is the North American Continental United States datum taken in 1927.
Select: AUTOMATIC OFF TIMER: **20 min** to automatically turn the unit off 20 minutes after it obtains a good fix or after 20 minutes of trying to get a good fix. This will help in extending battery life.

SETUP I/O
SERIAL: **Standard**

Other options within the setup pages are not used in GPS data collection for standard PNW-FIA inventories. See the Operations and Maintenance Manual for specific information.

F. Operating the PLGR on plot
Carry extra batteries at all times. The eight AA-alkaline batteries begin to lose power after approximately four hours of use. See Section K. Batteries, for more details.

Check the SETUP pages to make sure that the unit is in **CONT** (continuous) mode and that the rest of the SETUP settings are as described in Section E. PLGR setup options.

To see if the unit has obtained coordinates, press the POS key and scroll (using up/down arrows) until a page with UTM coordinates appears. If the unit is currently receiving good satellite signals, a **+-(number)ft** in the top-right corner will appear. This number represents the relative amount of error (in ft), based on the signal quality and number of satellites visible in the sky. If the word **OLD** appears instead, this indicates that the PLGR has not received enough good signals yet. In continuous mode the unit will continue to track satellites, and the distance error will decrease over time.

Getting into AVG mode
Once the error has decreased to +/- 70ft, switch the mode to Averaging (**AVG**). This can be achieved in one of two different ways:

First: select the Menu button, then arrow left or right until **SETUP** blinks, push either up or down arrow, the unit should now be in a Setup Page. Push arrow up/down until the top line says **SETUP MODE: CONT**, push right arrow once (**CONT** should now blink), Now push the down arrow twice, the display will change from **CONT** to **AVG**. Push the POS button, which display the position page. You should now see **AVG** and a five digit counter in the upper left corner.

Second (Short Cut): while at the position page in **CONT** mode push and hold the POS key for about 4-5 seconds and then release it, **AVG** and a five digit counter should appear in the upper left corner (return to **CONT** mode by repeating this same procedure).

While in **AVG** mode it is important that the PLGR not be moved around, keeping the unit steady will insure accurate satellite readings. Always try to obtain at least 180 counter readings in averaging mode. Once over 180 readings have been collected, record the **Easting** and **Northing** coordinates and the elevation and other required variables into the Husky data recorder. If the readings do not decrease to +/-70ft after the first 15 min, switch to averaging mode anyhow, but be sure to record the error figure in the appropriate field. Try to obtain better coordinates for the plot at a different subplot or later in the day.

G. Using RNG-CALC to compute the coordinates of plot center
If for some reason you can't get an adequate set of readings at plot center, you may use the RNG-CALC waypoint function to calculate the coordinate at plot center. Take the PLGR to a location where you will be able to collect 180 averaged readings at ± 70ft accuracy, and where you will be able to accurately

measure the horizontal distance, azimuth and slope in degrees to plot center. Do not move to a distance more than 200ft away if you don't have a laser range finder.

- Collect, in Averaging Mode, at least 180 readings and store this location as a waypoint (see the following section on Waypoints) Be sure to remember what waypoint number it was assigned.
- From the Waypoint (WP) menu select RNG-CALC.
- In the "from WP000" field change the waypoint number to the one you just collected.
- At the RNG field fill in the **horizontal** distance to plot center.
- At the AZ field fill in the azimuth from the point of coordinate collection to the plot center.
- Change EL (elevation) to ELA (elevation angle) fill this number in degrees. (This step is used so that the plot's elevation can be computed)
- Scroll down to the next screen, this displays the calculated location of plot center.
- If you wish to save the calculated location as a waypoint scroll down to the next screen. Change the number/name of the waypoint if desired. Select "STORE" so that it is flashing, then hit an up or down arrow.

H. Waypoints (Advanced GPS use)

Creating a waypoint (when coordinates are given)
A waypoint is a fairly precise location (on the ground, for our purposes), that a GPS user may assign a number and/or label to identify. The PLGR can store up to 999 waypoints in it's internal memory. For the purposes of PNW-FIA the location format of choice is called UTM/UPS (Universal Transverse Mercator/Universal Polar Stereographic). This format allows for the following required information: **Zone**- a 2 digit number (01-60) with a letter (C-X) attached. For our purposes, all zones in the western U.S. will be any combination of the numbers **10**,**11** and letters **U**, **T**, or **S**. **Easting**- a seven digit number (usually the first digit will be a zero) that represents distance from the eastern boundary of the particular zone. **Northing**- also a seven digit number that represents distance north of the equator (Northing numbers are usually instrumental in determining what zone the coordinates are in).

To create a new waypoint when the UTM coordinates are given in the husky (page 27), turn on the PLGR and then push the WP button. This will bring up the WP menu page with **ENTER** blinking. Push either the up or down arrow. Now see a screen showing **WP(3 digit #)** and a label **UNUSED###** on the top line is displayed. To change the preassigned waypoint number and/or label see Editing a Waypoint below. Otherwise push the right button four times until the two digit zone number field is blinking. The zone information should be given in the husky (If not, look at the POS screen while getting good signals and use the zone displayed, it should be **10** or **11**). Then push either up/down button which will start the first digit blinking. Push the up/down button again to scroll and select the number needed. Then push the right arrow and repeat the same procedure for the second digit. When finished with the numbers push the right arrow to select (blinking) the zone letter (**U**, **T**, or **S**). Then again push the right arrow and the Easting coordinate will begin to blink. The best way to enter numbers for **Easting** and **Northing**, is to push the NUM LOCK key and enter numeric mode (thus shifting all the keys into the orange print numbers and turning the **P** in the lower right corner to an **N**). If an error is made while in numeric mode just push CLR to go back to the last digit or start over with the first digit of the coordinate being entered. When finished entering the coordinates, push the right arrow button and continue with elevation, if desired. Then push NUM LOCK to go back to command mode (**P** in lower right corner). Now push the right arrow button until two small up/down arrows appear to the left of the **P**. Push either up or down arrow and a screen will confirm with **WAYPOINT STORED**. The waypoint created is now stored in the PLGR's memory. To navigate to this waypoint see Section J. Navigating with the PLGR.

Editing a waypoint
After storing a waypoint in the PLGR's memory it may be given an alphanumeric label. To do this, turn the unit on and push the WP button once the POS screen has appeared (about 5 sec.). The WP menu page with **ENTER** blinking will be displayed. Push on the right arrow so that **EDIT** is blinking and then push on either up/down arrow. Now see **WP (3 digit#)** in the upper left corner (as well as all the coordinate info for the selected waypoint). Push the right arrow twice and a small up/down arrow will appear to the right of the 3 digit number. Now push the up or down arrow to select the waypoint number you want to assign a name to (note: if after scrolling through all the stored waypoints you cannot find the

one you are looking for; it may not have been entered properly). Once you have found the appropriate waypoint push once on the right arrow, this will select (causing to blink) the word in the upper right (the word will be preassigned by the PLGR and will typically be either **WP###** , **MARK###,** or **UNUSED###**) . Pushing on the up or down arrow will cause only the first character to begin blinking. At this point you can push on the up or down arrow to scroll through a set of letters/numbers/symbols/blanks to place in the first character slot. After selecting the first character push the right arrow to select (blinking) the second character. Repeat the same procedure for up to 10 characters in length. If you want the name to be less than 10 characters, blank out the remaining characters and then after the final blank push the right arrow which will bring you to the coordinate information in the lower ¾ of the screen [see: Creating a Waypoint (when coordinates are given) above] If they are already good as is, then push the right arrow until the small up/down arrows appear to the left of the P (lower right corner). Now push either up/down arrow and the screen will flash: WAYPOINT STORED. The waypoint is now in memory and ready for navigational purposes.

Marking (storing) your current location
This feature is used to mark/store a current location as a waypoint in the PLGR's internal memory bank. Storing the location of a vehicle, RP, campsite, or starting point is a good example on how you can use this feature in the field. Stored waypoints can be useful in approaching locations in a different way, taking a different route back to the vehicle, or if you should get lost (see navigating to a waypoint).

To start, make sure the unit is on and you are receiving good signals. Check the POS screen (see Section F. Operating the PLGR) and be sure that you are getting a **+-(numbers)ft** in the upper right corner (Marking can be done in **AVG** or **CONT** mode). If the display still says **OLD**, you must wait until the PLGR gets better signal reception. Of course, the smaller the **+-(number)ft**, the better the accuracy of the stored waypoint.

Once you have confirmed good signal reception push on the MARK button. **MARK POS WP:** with a blinking 3 digit number should appear at the top of the screen. You can now select a number (1-999), to assign as a waypoint for your current location by pushing on the up/down arrows. **NOTE:** unless you wish to assign an alphanumeric name to the waypoint (see Editing a waypoint), write down or remember the number you are assigning and what you are assigning it to (truck, RP, etc.). While you are pushing the up/down arrows the **MARK POS WP:** may change to **OVERWRITE WP:** This means that you have selected a waypoint that already exists and it is asking if you want to overwrite it. If you choose to overwrite, the original waypoint will be lost and your current location will replace it. Once you have selected a waypoint number (either new or overwrite) push the MARK button again and a message of: "**WAYPOINT MARKED**" should flash on the screen and you will be returned to the POS screen. The PLGR's current location (under the assigned WP number), is now stored in it's memory and can be used to navigate with.

Deleting waypoints
Occasionally, you may wish to delete a waypoint from the PLGR's memory. To do this, turn the unit on, and when the POS page appears (about 5 sec.), push the WP button. You should now see the WP menu page with **ENTER** blinking. Since you are deleting a waypoint that already exists, push the left/right arrow until **CLEAR** is blinking, and then push either up/down button. You will now see: **CLEAR frm WP: 3 digit#** and **to WP: 3 digit#** as well as **ACTIVATE** and a blinking **QUIT**. Push once on the right arrow and the top 3 numbers (next to **frm WP:**) should be blinking. Push the up arrow and only the first of three digits will be blinking. Now, select the appropriate number by pushing either up/down arrow (**NOTE:** you can also push the NUM LOCK key which will shift the keypad to the 10 digit quick entry mode. If you make a mistake while entering numbers in this mode, push CLEAR/MARK and you can then start over. Also, remember to push NUM LOCK again when you have finished entering all the numbers). Once finished with the first digit push the right arrow and repeat for the second and then again for the third digit. After you finish with the third digit, push the right arrow and the second (next to **to WP:**) set of numbers will begin blinking. To delete only one waypoint select the same number for both the **frm** and **to WP:** (example: If you want to delete WP 001, then select 001 for the top number set as well as the bottom). To delete an entire range of waypoints select the appropriate range of numbers and all inclusive waypoints will be deleted (example: to delete WP 001 thru WP 009, select 001 for the top number set, and 009 for the bottom number set). After entering the bottom number set, pushing the right arrow should

cause **ACTIVATE** to blink. Push either up/down arrow and a **CONFIRM CANCEL** screen will appear. The screen will also show what is going to be cleared at the top (If you screwed up the WP(s) to be cleared, **CANCEL** should already be blinking, so push up or down arrow and you will be returned to the WP page). If the WP(s) you want to clear are at the top of the screen, then push left/right arrow until **CONFIRM** is blinking and then push either up/down arrow. A screen will show what has been cleared and instruct you to push either up/down arrow. After pushing the key you will be returned to the WP page and can proceed to any other command pages.

I. LOW SIGNAL Mode

Under very dense canopies tree crows can weaken the satellite signals reaching the PLGR's antenna. If you are under a dense canopy and are having trouble getting readings you can try switching to "LOW SIGNAL" mode. There is no "LOW SIGNAL " mode in the setup menu but you can get into this mode by following these steps:

- Go to the SETUP MODE screen and switch the mode to "STBY"
- Press the "MENU" button and return to the SETUP MODE screen
- Switch the mode to "AVG"
- Go to the position screen

The PLGR is now in "LOW SIGNAL" mode and will accept more signals from the satellites.
To get out of this mode go to the SETUP MODE screen and select any other mode.

J. Navigating with the PLGR (Advanced GPS use)

To begin navigation, you must first have a waypoint stored in the GPS unit (see Section G. Waypoints). Also, unless you have a good sense of azimuth (to the nearest few degrees), a compass will be needed. (**NOTE:** keep the compass away from the body of the GPS to keep it from affecting the magnetic accuracy). Once you know which waypoint number you are going to travel towards, turn the PLGR on and then, after the POS screen appears, push the NAV button. You will see a screen with only the two top lines in use and a **P** with small up/down arrows to the left of it. Push the right arrow once and the word (either: **SLOW**, **2D FAST**, **3D FAST**, or **CUSTOM**) in the upper left corner should begin blinking. Push either of the up/down arrows until **SLOW** is blinking, then push the right arrow. Now the second word will blink; this time select **DIRECT** by pushing either of the up/down arrows. Now, push the right arrow twice and a small set of up/down arrows will appear to the right of the waypoint number. By pushing the up/down arrow you can now scroll through all the waypoints stored in the PLGR (as you scroll through the waypoints, any labels attached will show to the right). Once you have found the waypoint you want to navigate to, push the right arrow and a small set of up/down arrows will appear to the left of the **P** (bottom right corner). Push the down arrow and you should see the following:

(LABEL OF WAYPOINT)		**+-(number)ft**
AZ	**(number)° T**	
RNG	**(number) ft**	
ELD	**+-(number)ft**	**⧫P**

If you are getting satellite signals then you should see a number in the upper right corner (**+-…ft**), if not then you will see **OLD**. If OLD is present then move in the general direction of the waypoint and hope that satellites will come into better view (or you may want to let the GPS sit for a few minutes to lock on to some signals). Now you are on your way, on this screen you can see the azimuth (**AZ**) from your current location to the waypoint. As well as the distance (**RNG**) in feet and +- elevation (**ELD**). **ELD** represents how many feet you are above/below the elevation of the waypoint. Follow the azimuth as you walk towards the waypoint and the distance should steadily decrease. Eventually, as you get closer to the waypoint, the distance will get very small (about 10-30ft), and the azimuth will begin to jump around dramatically. This means that you are real close to your destination (so look for the stake and witness trees if the waypoint is subplot 1).

K. Batteries

PLGR machines use eight AA batteries, which usually last for about four hours of use. These are called the **primary batteries**. The machine also has an internal **memory battery** which can briefly operate the

machine while the primary batteries are discharged or removed. **Never** remove both the primary and memory battery at the same time or never remove one of the batteries when the other one is discharged! If this occurs the CRYPTO key described in Section D. will be erased and the machine will need to be returned for service.

Primary batteries
When the timer in the PLGR shows the primary batteries are depleted the unit displays a **LOW PRIMARY BATTERY** warning. At this time, the eight AA batteries should be replaced using the large round screw-on cover at the top of the machine. Because the PLGR does not check the voltage of batteries, but uses a timer to determine when they are due to be replaced, it is imperative that the timer be reset when the new batteries are installed. **To reset the battery timer:** Push the menu button, and a screen will appear with **STATUS** blinking in the upper left corner (If **STATUS** is not blinking then push either left or right arrow until it is). Push either of the up/down arrows and you should see a screen with **GPS good, Self-Test OK…etc**. Push the down arrow and you will see the battery screen. Push the right arrow which will cause the choice to the right of **BATTERY** to blink. Make sure (by pushing either up or down button) to select **AA-Alk** (AA alkaline). Then push the right arrow a few times to select (blinking) **RST**. Now push either of the up/down buttons and the **hr./min. used** to the left should reset to zeros. The battery counter is now reset, you can return to the POS page by pushing the POS key.

Memory battery
When the internal memory battery is low (about once a year) a LOW MEMORY BATTERY warning is displayed. Replace the battery as soon as possible (definitely before using the PLGR on another plot). Each crew supervisor will have several spares. The 3.6v lithium battery is replaced at the sealed cap at the bottom of the PLGR. The (+) end (end with the knob) is inserted first. Do not remove the memory battery while the primary batteries are removed or discharged.

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XIII. LASER 200 INSTRUCTIONS

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XIII. LASER 200 INSTRUCTIONS

A. Overview

Accurate heights are necessary in our inventory in order to determine volume and for other uses. The Laser can be used to get fast and accurate tree heights. It can also be used to measure distances and % slope. This instrument is more fragile than the GPS units. Some precautions must be taken with the Lasers to keep them working properly. These are:

1. Never look at the sun through the scope. Looking directly at the sun can permanently damage your eyes.
2. Never point the Laser directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.
3. Do not expose the Laser to extreme temperatures. It is rated for a temperature range of -22 deg. F to +140 deg. F. Don't leave the instrument in the vehicle during the heat of the day.
4. Do not use batteries with "voltage check" features built on the batteries. The battery case of the Laser is too narrow for these batteries, and they could get stuck in the instrument.
5. Do not drop the Laser. Immediately return it to it's case when you get back to the vehicle. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

B. Basic operation

All directions for using the Laser buttons are given assuming you are holding the instrument with the LCD display screen facing you and the 2 round lenses are facing the object you want to measure. The buttons will be referred to as:

L1	the left button closest to you
L2	the left button in the middle
L3	the left button furthest away from you
R1	the right button closest to you
R2	the right button in the middle
R3	the right button furthest away from you

Turn the Laser on by pushing L1 or R1
Turn it off by pushing L2 and L3 at the same time. The Laser may turn itself off after a period of inactivity. Once the instrument is on, push the R1 button to make the red dot appear in the sighting scope. If there is no red sighting dot, repeatedly push the L2 button until the red dot appears and is the correct brightness.
To light up the display screen, press L3. Press L3 again to turn off the light.

C. Settings

Make sure the settings are correct before using the Laser. To set the correct measurement units, go into the main menu and:

1. Press R2 or R3 to scroll through the menu until SYS is displayed in the upper right hand corner of the screen.
2. Press R1. ON or OFF will show in the center of the screen. FILTER will flash at the bottom.
3. Press R2 until OFFSET is flashing. The number displayed should be 0000.00.
4. Press R2 until PIVOT is flashing. The number displayed should be 0000.59. When this number is set at 0.00, the Laser is set to calculate heights using a tripod attached to the center of the instrument. The pivot point is the center of the Laser. We use the pivot value at 0.59 because this sets the pivot point at the rear of the instrument, and this allows you to shoot a height while using your head as the pivot point. To change this number, press L1 until the number you want to change is flashing. Press L2 or L3 until the correct number is showing. When the number is set at 0000.59, press R1.
5. Press R2 until UNITS is flashing. Select F (feet) using the R1 button.
6. Press R2 again and D (degrees) should be flashing. If not, press R1 to toggle on D.
7. Press R2 again and % should be flashing. It should say ON. If not, press R1.
8. Press R3 twice to accept the new settings and back out to the main display.

D. Filter and Reflectors

When you are working in areas of dense brush, you need to make sure the Laser is giving you the distance to the correct target. The best way to do this is to use a reflector as a target and use the filter option on the Laser. The Laser will only lock onto the highly reflective targets and ignore the less reflective brush. To use the filter option:

1. Place a reflector (or have someone hold it) on the tree where it can be seen from the required distance. The Laser will not work in the filter mode without a reflector as a target.
2. Go to the main menu on the Laser and push R2 or R3 until SYS is displayed on the screen.
3. Press R1 to select the SYS option. The FILTER option will blink, and it will say the FILTER is OFF or ON.
4. Push R1 to toggle FILTER between ON and OFF.
5. Press R3 to save the desired setting and to back out into the main display. When the FILTER is on, FILTER will appear at the bottom of the screen when the Laser is measuring distances.

E. Distances and % slope

Horizontal distance (HD): Turn the Laser on. The top-middle of the LCD screen will say HD. Point the red sighting dot at the target. Press R1 and hold it down until the Laser locks on the target, then release. You can tell when the instrument locks onto it's target by sound. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If you get an error message, simply aim again and press R1.

Slope distance (SD) and Vertical distance (VD): Push R2 or R3 until the correct display is shown. Then aim and press R1 until the Laser locks on target. Or, measure a horizontal distance, then push R2 until the correct display is shown.

% slope: Press R2 or R3 until INC is displayed. Then aim and press R1.

F. Tree heights

The best way to measure a tree height is to make sure you have a clear shot at the leader or a clear shot of the tree trunk. Make sure you are getting a distance to the tree trunk, and not some branches in front of it. If you can't get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once you are in position with your target in sight, go to the main menu:

1. Push R2 or R3 until HT is displayed in the upper left of the screen.
2. Push R1 once, aim at the target, then push R1 until the Laser locks on target. This will measure the horizontal distance.
3. The down arrow will flash. Aim at the base of the tree and push R1 to get the % slope.
4. The up arrow will flash. Aim at the top of the tree and push R1 again to get another % slope.
5. Press R1 once more and the Laser will display the height. Make sure this height is reasonable before recording it in the Husky.

G. Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help you make sure you are hitting the right target when objects near you or just beyond your target might give you false readings. You don't have to set both gates. You will probably only need to set the short gate because of brush or fog between you and your target. You can set a gate by shooting a target or by entering distances into the instrument. To set a short gate by laser, go to the main menu and:

1. Press R2 or R3 until GATE is shown on the display.
2. Push R1 to select the gate option.
3. Press R1 to toggle the gate between ON and OFF.
4. Push R2. The S indicator will flash.
5. Aim at a target that is at the distance you want to set as the short gate and press R1.

6. Now you can either set a long gate, or press R3 to go back to save the short gate and return to the main menu. The S will be displayed when you are measuring distances to show the short gate is on.

To set a long gate:

7. Push R2. The L indicator will flash.
8. Aim at an appropriate target and press R1
9. Press R3 to save the gate and go back to the main display. The L will be displayed when measuring distances.
   The gates are reset to OFF when the Laser is turned off, but gate values are saved in memory. This means that if you have saved a gate and turn off the instrument, when you turn it back on the gate will be set to OFF. If you go back into the gate option and turn the gate ON, it will remember the last distances you shot for the long and short gates.

To clear out a gate value: Display the gate values by following the instructions in this section (section G). When the desired gate value is displayed, press and hold down R3 until the number is deleted.

H. Cumulative distances

A cumulative distance measurement allows you to move from one target point to the next, stopping at each one to measure the distance to the next target point. The Laser accumulates the measured distances in both slope and horizontal distances (SD and HD) to give you a running total.
To take a cumulative distance, go to the main menu and:

1. Press R2 or R3 until MULTI is displayed on the screen.
2. Press R1 to enter the MULTI option. DIFF will be displayed.
3. Press R2 once. CUM will be displayed.
4. Press R1. Either SEL or a number will be displayed. If SEL is displayed, HD will flash on and off. Press R1 to toggle between HD and SD. Press R2 when the correct indicator is flashing. If a number is displayed, that means there is already a cumulative distance saved on this instrument. You can either clear out this distance by holding down R3 until 0.00 appears, or continue to add to the distance by going to step 5.
5. Aim at the target and press R1 to fire the laser.
6. If you are not satisfied with the measurement, repeat step 5 to retake the measurement. If you are satisfied with the measurement, and wish to add it to your total, press R2. The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

   You can choose whether you want horizontal or slope distances at any time. If a distance has been measured, you can change from slope or horizontal distance by pressing R3 twice. SEL will be displayed. Push R1 to toggle between SD and HD. Press R2 twice to get back to the total distance. Go to step 5 to add more distances.

   The cumulative measurement total is saved in memory even if the instrument is turned off. Turn the instrument on and scroll back to the MULTI-CUM option and resume the procedure with step 5. To clear out the current total and begin another series of measurements, hold down R3 while the cumulative distance is showing until the number is deleted.

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XIV APPENDICES

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APPENDIX 1 -- SLOPE CORRECTION TABLE

PERCENT	EXPANSION FACTOR	EXPANSION FACTOR RECIPROCAL	--SLOPE DISTANCE-- 24.0 ft.	55.8 ft.	100 ft.
10	1.005	0.995	24.1	56.1	100.5
15	1.01	0.99	24.3	56.4	101.1
20	1.02	0.98	24.5	56.9	102.0
25	1.03	0.97	24.7	57.5	103.1
30	1.04	0.96	25.1	58.3	104.4
35	1.06	0.94	25.4	59.1	105.9
40	1.08	0.93	25.8	60.1	107.7
45	1.10	0.91	26.3	61.2	109.7
50	1.12	0.89	26.8	62.4	111.8
55	1.14	0.88	27.4	63.7	114.1
60	1.17	0.86	28.0	65.1	116.6
65	1.19	0.84	28.6	66.6	119.3
70	1.22	0.82	29.3	68.1	122.1
75	1.25	0.80	30.0	69.8	125.0
80	1.28	0.78	30.7	71.5	128.1
85	1.31	0.76	31.5	73.2	131.2
90	1.35	0.74	32.3	75.1	134.5
95	1.38	0.72	33.1	77.0	137.9
100	1.41	0.71	33.9	78.9	141.4
105	1.45	0.69	34.8	80.9	145.0
110	1.49	0.67	35.7	83.0	148.7
115	1.52	0.66	36.6	85.0	152.4
120	1.56	0.64	37.5	87.2	156.2
125	1.60	0.62	38.4	89.3	160.1
130	1.64	0.61	39.4	91.5	164.0
135	1.68	0.60	40.3	93.7	168.0
140	1.72	0.58	41.3	96.0	172.0
145	1.76	0.57	42.3	98.3	176.1
150	1.80	0.55	43.3	100.6	180.3
155	1.84	0.54	44.3	102.9	184.5

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APPENDIX 2 -- HORIZONTAL LIMITING DISTANCE TABLE

7M BAF (1.57465)				30 BAF (1.58771)			
DBH (in.)	Distance (ft.)	DBH (in.)	Distance (ft.)	DBH (in.)	Distance (ft.)	DBH (in.)	Distance (ft.)
0.1	0.16	1	1.57	0.1	0.16	1	1.59
0.2	0.31	2	3.15	0.2	0.32	2	3.18
0.3	0.47	3	4.72	0.3	0.48	3	4.76
0.4	0.63	4	6.30	0.4	0.64	4	6.35
0.5	0.79	5	7.87	0.5	0.79	5	7.94
0.6	0.94	6	9.45	0.6	0.95	6	9.53
0.7	1.10	7	11.02	0.7	1.11	7	11.11
0.8	1.26	8	12.60	0.8	1.27	8	12.70
0.9	1.42	9	14.17	0.9	1.43	9	14.29
		10	15.75			10	15.88
		11	17.32			11	17.46
		12	18.90			12	19.05
		13	20.47			13	20.64
		14	22.05			14	22.23
		15	23.62			15	23.82
		16	25.19			16	25.40
		17	26.77			17	26.99
		18	28.34			18	28.58
		19	29.92			19	30.17
		20	31.49			20	31.75
		21	33.07			21	33.34
		22	34.64			22	34.93
		23	36.22			23	36.52
		24	37.79			24	38.11
		25	39.37			25	39.69
		26	40.94			26	41.28
		27	42.52			27	42.87
		28	44.09			28	44.46
		29	45.66			29	46.04
		30	47.24			30	47.63
		31	48.81			31	49.22
		32	50.39			32	50.81
		33	51.96			33	52.39
		34	53.54			34	53.98
		35	55.11			35	55.57
		36	56.69			36	57.16
						37	58.75
						38	60.33

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APPENDIX 3 -- DETERMINATION OF STOCKING VALUES

NOTE: This is a shortcut method for field use. It is not the method used in compiling stocking.

Stocking values are required to determine if a CONDITION STATUS = 1 (accessible forest land) exists in a condition. CONDITION STATUS will determine which data items must be recorded for the condition. When the CONDITION STATUS is in question (usually a nonforest area that is in the process of reverting to forest land or a marginal site that can only support a low number of trees) the crew must determine if there is sufficient stocking to classify the condition as forest. A minimum stocking value of 10% is required for accessible forest land (unless the condition was previously forested, such as a recent clear cut or burned area).

The following tables show the contribution of each tallied toward this minimum stocking value. In the determination of stocking the field crew should consider the condition over its entire area, not just the trees and seedlings that would be tallied on the subplots and microplots, especially when the plot straddles a condition boundary. Also, for stocking purposes consider a clump of trees (e.g., stump sprouts) all less than 5 in DBH to be a single tree.

The number of trees per acre needed to obtain minimum stocking depends on the DBH of largest tree in the condition (not necessarily a tally tree), the forest type of the condition, and the size of the sampled trees.

This method of determining stocking is most effective in areas where there has not been recent disturbance. Evidence of a recent disturbance that reduced the stocking (cutting, fire, etc.) should be considered when making the final decision between non-forest land and forest land. For example, if an area has recently burned and not enough time has elapsed for the burned trees to be replaced by seedlings, you could count the stumps in your tally as if they were live in order to determine what the stocking had been previous to the fire.

If the condition covers all four subplots entirely and the trees are distributed fairly evenly over the entire condition area:

The following steps can be used to determine if the condition has the minimum level of stocking to be classified as forest land:

Observe the diameter of the largest tree on the condition and classify the condition into one of the following groups, $\geq$5 in, 4.0-4.9 in, 3.0-3.9 in, 2.0-2.9 in, 1.0-1.9 in, or < 1.0 in DBH class. If a 5inch DBH or larger tree is present, Table A6b will be used, otherwise use Table A6a.

Determine the appropriate forest type of the condition based on the tree species present in the condition and/or the forest type of similar conditions in the area. Forest type may be hard to determine, however if it is determined that the condition is forest, then a forest type must be assigned to the condition. (Keep in mind that the stocking contribution of sampled trees is based on the forest type not the species of the individual trees being counted. Do not mix values from different forest type rows.)

Each tree on a subplot or microplot will represent a certain contribution to the percent stocking in the condition. When the sum of theses values reaches 10% the condition can be considered

forestland. Trees ≥5 in DBH are sampled using 24-ft radius subplots, trees <5 in DBH can be sampled using either the 6.8-ft microplots or the 24-ft radius subplots. The values for trees sampled with a 24-ft radius subplot are in the top-half of the tables while the values for trees sampled using a microplot are in the lower half and are shaded. In stands of smaller trees that are sparse or where trees are occur in patches, a more accurate observation of tree stocking can be determined by observing trees < 5.0 in DBH on the 24-ft radius subplot. Use your judgment as to whether trees <5 in DBH should be sampled on the subplot instead of the microplot but do not mix the two methods. (Note: the sampling of trees <5 in DBH on the 24-ft subplot is used only to determine the level of stocking, they are not to be entered as regular tally trees. If the condition is determined to be forest land you will need to sample trees <5 in DBH on the microplots as you normally would.)

Example 1: The potential forest type is lodgepole, and the largest tree in the condition is >5 in DBH (use table A6b). An 8.5 in DBH lodgepole is sampled on subplot 1 (1.2%), two grand-fir seedlings are sampled on the microplot at subplot 2 (0.57% * 2), at subplot three there are two 10.0 inch lodgepole pines on the subplot (1.77% * 2) and 3 lodgepole seedlings on the microplot (0.57% * 3), there is no tally at subplot 4 (0%). Combining all the totals gives a value of 7.59% stocking, since this is <10% the condition is not forest land.

Example 2: The potential forest type is lodgepole, and the largest tree in the condition is 4.8 in DBH (use table A6a). The distribution of trees is very patchy so the crew decides to sample all trees on the 24-ft subplot radius. The combined tally of all four subplots is 75 lodgepole seedlings (0.06% * 75), 2 alder seedlings (0.06 * 2), 5 lodgepole pines between 1.0 & 1.9 in DBH (0.13% * 5), and 20 lodgepole pines between 4.0 & 4.9 in DBH (0.35%* 20). Stocking is 12.27%, the condition is forest land and will be measured in the normal manner.

If the condition does not cover all four subplots entirely or the trees are not uniformly distributed throughout the condition:

If the condition occurs on only a small portion of the plot, (no subplot centers fall in the condition), use your best judgment in assigning CONDITION STATUS. When judgment is used to assign CONDITION STATUS, a note should be made on the plot sheet.

If a subplot center falls in a condition where CONDITION STATUS is in question but the condition contains fewer than four complete representative subplots, additional temporary subplots are used to assign land use. If there is a clear condition boundary on a subplot or the subplot seems to be in a transition area where one condition grades into another (the stocking on the subplot is not typical of the condition), take stocking tally on a temporary subplot in another location. When subplots fall entirely outside the condition in question, add an additional temporary subplot that is within entirely within the condition. Continue to add temporary subplots until you have four subplots (temporary and standard) completely within the condition.

In cases the where the distribution of trees within a condition is not uniform, use your judgment to decide if four subplots are adequate to obtain a representative sample of stocking in the condition. If you decide that four subplots is not sufficient, add temporary subplots until you have eight complete representative subplots. When using eight subplots divide the contribution of each tree by two.

When additional temporary subplots are used to assign land use, a note should be made on the plot sheet and the locations of the temporary subplots should be diagramed. Use the following procedure to establish these temporary subplots in a condition:

A. Consider locations 120.0 ft horizontal distance from the highest numbered subplot in the condition. First consider the location 0^{o} azimuth from the subplot center. If this location is unsuitable, consider in order locations at azimuth 120^{o}, and 240^{o}. When a suitable location has been found, establish the temporary subplot. Temporary subplots should be entirely within the condition (locations should not be within 24.0 ft of a mapped boundary).

B. If Step A fails to yield a suitable subplot location, repeat Step A at each of the next highest numbered regular subplot in the condition.

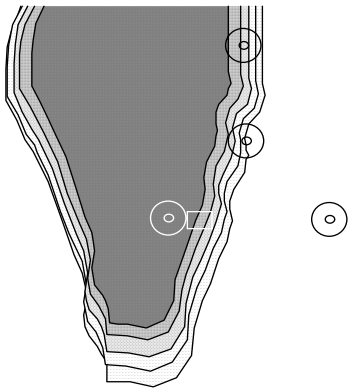
C. If Steps A and B have been exhausted and a suitable temporary subplot still has not been found, repeat Step A at each temporary subplot in turn beginning with the first temporary subplot that was established.

D. If the condition is so small that not enough temporary subplots will fit using 120.0 ft spacing, repeat the above steps using a horizontal distance of 60.0 ft. Keep in mind the minimum size requirements for a condition (1 acre in area, and 120 ft in width).

If more than one temporary subplot is to be established, repeat Steps A and B to establish the second lowest numbered temporary subplot next, and continue in order until you have four (or eight) temporary subplots established in the condition to get a good, representative estimate of stocking. The general rule for establishing temporary subplots is:

- Install the lowest temporary subplot off the highest established subplot, until all the established subplots have been exhausted.
- Then establish the lowest temporary subplot yet to be established off the lowest one already established (lowest off highest, then lowest off lowest).

Once the temporary subplots are established they are measured in the same manner as in the previous section. Temporary subplots are intended only to be a tool to determine CONDITION STATUS, they are not meant to be permanent substitutes for subplots in standard locations. Once CONDITION STATUS has been determined measure the plot in the standard way.



Here the dark shaded area is trees, surrounded by a treeless area or an area with only scattered trees. It could be a forest island surrounded by marsh/bog, a wooded draw in a grazed area, or a farm woodlot that is invading an abandoned field. Between the forest and the nonforest is a transition zone that is about 40 to 80 ft wide. Because there is a transition zone, not an abrupt forest/nonforest edge, no mapping is done. Subplots 1 and 3 are recorded as 100% in condition 1 and subplots 2 and 4 are put in condition 2. To determine the stocking in condition 2 you should exclude subplot 2 because it is in a transition zone. Two temporary subplots should be installed off subplot 4 to have an adequate sample for determining the stocking of condition 2. Similarly, to get a stocking for condition 1, subplot 1 would be excluded and three temporary subplots should be installed off subplot 3.

Table A6a. Contribution of individual trees toward minimum stocking (stocking value 10%) of forest land in conditions with no trees >5 in DBH.

	DBH of largest tree in the condition														
	4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		<1.0
	DBH of tally tree														
Forest type	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	<1.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0	2.0-2.9	1.0-1.9	<1.0	1.0-1.9	<1.0	<1.0
	subplot values														
Western larch	0.40%	0.32%	0.23%	0.15%	0.06%	0.38%	0.27%	0.18%	0.08%	0.35%	0.22%	0.10%	0.33%	0.15%	0.30%
Black spruce	0.50%	0.40%	0.32%	0.23%	0.14%	0.55%	0.43%	0.30%	0.18%	0.60%	0.43%	0.23%	0.67%	0.35%	0.67%
Lodgepole pine	0.35%	0.27%	0.21%	0.13%	0.06%	0.33%	0.24%	0.16%	0.07%	0.32%	0.20%	0.09%	0.30%	0.14%	0.27%
W. white pine	0.30%	0.23%	0.17%	0.11%	0.04%	0.27%	0.20%	0.13%	0.06%	0.26%	0.17%	0.07%	0.24%	0.11%	0.22%
Ponderosa pine	0.43%	0.33%	0.25%	0.16%	0.07%	0.40%	0.30%	0.19%	0.08%	0.38%	0.25%	0.11%	0.35%	0.17%	0.33%
Douglas fir	0.50%	0.40%	0.30%	0.19%	0.09%	0.50%	0.35%	0.24%	0.11%	0.46%	0.32%	0.15%	0.46%	0.22%	0.46%
Western hemlock	0.33%	0.27%	0.20%	0.13%	0.05%	0.32%	0.24%	0.15%	0.07%	0.30%	0.20%	0.09%	0.29%	0.14%	0.27%
Redwood	0.27%	0.21%	0.16%	0.10%	0.04%	0.25%	0.19%	0.12%	0.05%	0.24%	0.16%	0.07%	0.23%	0.11%	0.21%
Red alder	0.86%	0.67%	0.55%	0.35%	0.18%	0.86%	0.67%	0.43%	0.22%	0.86%	0.60%	0.30%	0.86%	0.46%	0.86%
Aspen	0.86%	0.67%	0.50%	0.32%	0.16%	0.86%	0.60%	0.40%	0.20%	0.75%	0.55%	0.26%	0.75%	0.40%	0.75%
Elm-ash-cottonwood	0.75%	0.60%	0.43%	0.26%	0.10%	0.67%	0.50%	0.32%	0.13%	0.60%	0.40%	0.17%	0.55%	0.25%	0.50%
Western juniper	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
	microplot values														
Western larch	5.00%	3.95%	2.88%	1.83%	0.76%	4.69%	3.41%	2.20%	0.94%	4.41%	2.78%	1.25%	4.16%	1.87%	3.75%
Black spruce	6.25%	5.00%	3.95%	2.88%	1.74%	6.82%	5.35%	3.75%	2.20%	7.50%	5.35%	2.88%	8.33%	4.41%	8.33%
Lodgepole pine	4.41%	3.41%	2.59%	1.63%	0.69%	4.16%	3.00%	1.97%	0.86%	3.95%	2.50%	1.14%	3.75%	1.70%	3.41%
W. white pine	3.75%	2.88%	2.08%	1.34%	0.56%	3.41%	2.50%	1.63%	0.69%	3.26%	2.08%	0.93%	3.00%	1.39%	2.78%
Ponderosa pine	5.35%	4.16%	3.12%	1.97%	0.82%	5.00%	3.75%	2.42%	1.03%	4.69%	3.12%	1.36%	4.41%	2.08%	4.16%
Douglas fir	6.25%	5.00%	3.75%	2.42%	1.12%	6.25%	4.41%	3.00%	1.39%	5.77%	3.95%	1.87%	5.77%	2.78%	5.77%
Western hemlock	4.16%	3.41%	2.50%	1.56%	0.68%	3.95%	3.00%	1.92%	0.85%	3.75%	2.50%	1.14%	3.57%	1.70%	3.41%
Redwood	3.41%	2.68%	1.97%	1.25%	0.54%	3.12%	2.34%	1.50%	0.67%	3.00%	1.97%	0.89%	2.88%	1.34%	2.68%
Red alder	10.71%	8.33%	6.82%	4.41%	2.20%	10.71%	8.33%	5.35%	2.78%	10.71%	7.50%	3.75%	10.71%	5.77%	10.71%
Aspen	10.71%	8.33%	6.25%	3.95%	1.97%	10.71%	7.50%	5.00%	2.50%	9.37%	6.82%	3.26%	9.37%	5.00%	9.37%
Elm-ash-cottonwood	9.37%	7.50%	5.35%	3.26%	1.25%	8.33%	6.25%	3.95%	1.56%	7.50%	5.00%	2.08%	6.82%	3.12%	6.25%
Western juniper	To calculate stocking% in this forest type, tally trees <5" DBH on the subplot radius.														

Table A6b. Contribution of individual trees toward minimum stocking (stocking value 10%) of forest land in conditions with at least one tree 5 in DBH or larger.

	DBH of tally tree																
Forest type	<1.0	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
	subplot values																	
Western larch	0.05%	0.12%	0.19%	0.26%	0.33%	0.75%	1.20%	2.01%	2.87%	3.76%	5.02%	6.02%	7.52%	8.60%	10.03%	12.04%	15.05%	15.05%
Lodgepole p.	0.05%	0.11%	0.17%	0.24%	0.30%	0.67%	1.20%	1.77%	2.51%	3.34%	4.30%	5.02%	6.02%	7.52%	8.60%	10.03%	12.04%	12.04%
W. white pine	0.04%	0.09%	0.14%	0.20%	0.25%	0.55%	1.00%	1.50%	2.15%	2.87%	3.54%	4.63%	5.47%	6.69%	7.52%	8.60%	10.03%	12.04%
Ponderosa p.	0.06%	0.13%	0.21%	0.29%	0.38%	0.86%	1.50%	2.23%	3.17%	4.30%	5.47%	6.69%	8.60%	10.03%	12.04%	12.04%	15.05%	15.05%
Douglas fir	0.08%	0.16%	0.25%	0.33%	0.43%	0.86%	1.50%	2.23%	3.17%	4.01%	5.02%	6.02%	7.52%	8.60%	10.03%	12.04%	12.04%	15.05%
W. hemlock	0.05%	0.11%	0.17%	0.23%	0.29%	0.60%	1.20%	1.67%	2.31%	3.17%	4.01%	5.02%	6.02%	6.69%	8.60%	8.60%	10.03%	12.04%
Redwood	0.04%	0.08%	0.13%	0.18%	0.23%	0.50%	0.86%	1.34%	1.88%	2.51%	3.17%	4.01%	4.63%	5.47%	6.69%	7.52%	8.60%	10.03%
Red alder	0.15%	0.30%	0.46%	0.60%	0.75%	1.50%	3.01%	3.76%	5.02%	6.02%	7.52%	8.60%	10.03%	12.04%	15.05%	15.05%	20.06%	20.06%
Aspen	0.13%	0.27%	0.40%	0.55%	0.67%	1.50%	3.01%	3.54%	4.63%	6.02%	7.52%	8.60%	10.03%	12.04%	15.05%	15.05%	20.06%	20.06%
Elm-ash-ctwd.	0.08%	0.22%	0.35%	0.50%	0.67%	1.50%	3.01%	4.01%	6.02%	8.60%	10.03%	15.05%	15.05%	20.06%	20.06%	30.09%	30.09%	30.09%
Western juniper	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
	microplot values																	
Western larch	0.63%	1.53%	2.42%	3.26%	4.16%													
Lodgepole p.	0.57%	1.36%	2.14%	3.00%	3.75%													
W. white pine	0.46%	1.14%	1.78%	2.50%	3.12%													
Ponderosa p.	0.69%	1.67%	2.68%	3.57%	4.69%													
Douglas fir	0.94%	2.03%	3.12%	4.16%	5.35%													
W. hemlock	0.57%	1.34%	2.08%	2.88%	3.57%													
Redwood	0.45%	1.06%	1.67%	2.27%	2.88%													
Red alder	1.87%	3.75%	5.77%	7.50%	9.37%													
Aspen	1.63%	3.41%	5.00%	6.82%	8.33%													
Elm-ash-ctwd.	1.04%	2.78%	4.41%	6.25%	8.33%													
Western juniper	To calculate stocking% in this forest type tally trees <5" DBH on the subplot radius.																	

DELETE FROM FINAL EDITION
SUMMARY OF CHANGES FROM ORIGINAL:

1. The original tables A6a and A6b indicated the number of trees per acre by forest type and tree diameter to reach 10% stocking. I converted these numbers into the contribution each tree tallied makes toward total stocking on a 4-subplot plot.
    - The area of 4 subplots is 0.1662acres, 1 tree ÷ 0.1662acres = 6.018 trees/acre
    - Therefore a sampled tree of a given diameter's contribution to stocking = (6.018 trees) ÷ (number of trees per acre of that diameter needed for 10% stocking).
    - The area of 4 microplots is 0.01334acres, 1 tree ÷ 0.01334acres = 74.965 trees/acre.
    - Therefore a sampled tree of a given diameter's contribution to stocking = (74.965 trees) ÷ (number of trees per acre of that diameter needed for 10% stocking).

    To determine the percent stocking the crew only needs to sum the contribution of trees as they are tallied, instead of determining the proportion of stocking met by tally in each diameter class and them summing those proportions.

2. These changes require that either four or eight subplots are required per condition instead of leaving the number of subplots up to the cruiser's judgment. This should simplify the math done in the field and reduce the possibility of error.

3. Fractional subplots are no longer allowed. This both simplifies calculations for the field crews (all trees tallied will have the same weight toward stocking-no need to calculate expansion factors) and estimates will be generated for areas that are more typical of the condition.

4. An additional step was added to the rules for establishing temporary subplots. The new rule will allow the installation of these subplots in conditions that are close to the minimum size to be a separate condition.

5. A row was added in each table for western juniper forest type. 40 trees per acre (any size) was used for the 10% stocking value.

6. In order to save space, forest types that do not occur in the west were removed.

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APPENDIX 4 -- FOREST TYPE CODES

This following list includes all forest types in the Continental U.S. and Alaska Types designated East/West are commonly found in those regions, although types designated for one region may occasionally be found in another. *These codes are used for **Item 5--FOREST TYPE** in Condition Class Attributes.*

East	West	Code	Species Type
E		**100**	**White / Red / Jack Pine Group**
E		101	Jack pine
E		102	Red pine
E		103	Eastern white pine
E		104	White pine / hemlock
E		105	Eastern hemlock
E		**120**	**Spruce / Fir Group**
E		121	Balsam fir
E		122	White spruce
E		123	Red spruce
E		124	Red spruce / balsam fir
E		125	Black spruce
E		126	Tamarack
E		127	Northern white-cedar
E		**140**	**Longleaf / Slash Pine Group**
E		141	Longleaf pine
E		142	Slash pine
E		**160**	**Loblolly / Shortleaf Pine Group**
E		161	Loblolly pine
E		162	Shortleaf pine
E		163	Virginia pine
E		164	Sand pine
E		165	Table-mountain pine
E		166	Pond pine
E		167	Pitch pine
E		168	Spruce pine
	W	**180**	**Pinyon / Juniper Group**
E		181	Eastern redcedar
	W	182	Rocky Mountain juniper
	W	183	Western juniper
	W	184	Juniper woodland
	W	185	Pinyon juniper woodland
	W	**200**	**Douglas-fir Group**
	W	201	Douglas-fir
	W	202	Port-Orford-cedar
	W	**220**	**Ponderosa Pine Group**
E	W	221	Ponderosa pine
	W	222	Incense cedar
	W	223	Jeffrey pine / Coulter pine / bigcone Douglas-fir
	W	224	Sugar pine
	W	**240**	**Western White Pine Group**
	W	241	Western white pine

East	West	Code	Species Type
	W	**260**	**Fir / Spruce / Mountain Hemlock Group**
	W	261	White fir
	W	262	Red fir
	W	263	Noble fir
	W	264	Pacific silver fir
	W	265	Engelmann spruce
	W	266	Engelmann spruce / subalpine fir
	W	267	Grand fir
	W	268	Subalpine fir
	W	269	Blue spruce
	W	270	Mountain hemlock
	W	271	Alaska-yellow-cedar
	W	**280**	**Lodgepole Pine Group**
	W	281	Lodgepole pine
	W	**300**	**Hemlock / Sitka Spruce Group**
	W	301	Western hemlock
	W	304	Western redcedar
	W	305	Sitka spruce
	W	**320**	**Western Larch Group**
	W	321	Western larch
	W	**340**	**Redwood Group**
	W	341	Redwood
	W	342	Giant sequoia
	W	**360**	**Other Western Softwoods Group**
	W	361	Knobcone pine
	W	362	Southwest white pine
	W	363	Bishop pine
	W	364	Monterey pine
	W	365	Foxtail pine / bristlecone pine
	W	366	Limber pine
	W	367	Whitebark pine
	W	368	Misc. western softwoods
	W	**370**	**California Mixed Conifer Group**
	W	371	California mixed conifer
E	W	**380**	**Exotic Softwoods Group**
E		381	Scotch pine
E	W	382	Australian pine
E	W	383	Other exotic softwoods
E		**400**	**Oak / Pine Group**
E		401	White pine / red oak / white ash
E		402	Eastern redcedar / hardwood
E		403	Longleaf pine / oak
E		404	Shortleaf pine / oak
E		405	Virginia pine / southern red oak
E		406	Loblolly pine / hardwood
E		407	Slash pine / hardwood

East	West	Code	Species Type
E		409	Other pine / hardwood
E		**500**	**Oak / Hickory Group**
E		501	Post oak / blackjack oak
E		502	Chestnut oak
E		503	White oak / red oak / hickory
E		504	White oak
E		505	Northern red oak
E		506	Yellow-poplar / white oak / red oak
E		507	Sassafras / persimmon
E		508	Sweetgum / yellow-poplar
E		509	Bur oak
E		510	Scarlet oak
E		511	Yellow-poplar
E		512	Black walnut
E		513	Black locust
E		514	Southern scrub oak
E		515	Chestnut oak / black oak / scarlet oak
E		519	Red maple / oak
E		520	Mixed upland hardwoods
E		**600**	**Oak / Gum / Cypress Group**
E		601	Swamp chestnut oak / cherrybark oak
E		602	Sweetgum / Nuttall oak / willow oak
E		605	Overcup oak / water hickory
E		606	Atlantic white-cedar
E		607	Baldcypress / water tupelo
E		608	Sweetbay / swamp tupelo / red maple
E		**700**	**Elm / Ash / Cottonwood Group**
E		701	Black ash / American elm / red maple
E		702	River birch / sycamore
E	W	703	Cottonwood
E	W	704	Willow
E		705	Sycamore / pecan / American elm
E		706	Sugarberry / hackberry / elm / green ash
E		708	Red maple / lowland
E	W	709	Cottonwood / willow
E	W	722	Oregon ash
E		**800**	**Maple / Beech / Birch Group**
E		801	Sugar maple / beech / yellow birch
E		802	Black cherry
E		803	Cherry / ash / yellow-poplar
E		805	Hard maple / basswood
E		807	Elm / ash / locust
E		809	Red maple / upland
E	W	**900**	**Aspen / Birch Group**
E	W	901	Aspen
E	W	902	Paper birch
E	W	904	Balsam poplar
	W	**910**	**Alder / Maple Group**
	W	911	Red alder

East	West	Code	Species Type
	W	912	Bigleaf maple
	W	**920**	**Western Oak Group**
	W	921	Gray pine
	W	922	California black oak
	W	923	Oregon white oak
	W	924	Blue oak
	W	925	Deciduous oak woodland
	W	931	Coast live oak
	W	932	Canyon live oak / interior live oak
	W	**940**	**Tanoak / Laurel Group**
	W	941	Tanoak
	W	942	Califonia laurel
	W	943	Giant chinkapin
	W	**950**	**Other Western Hardwoods Group**
	W	951	Pacific madrone
	W	952	Mesquite woodland
	W	953	Cercocarpus woodland
	W	954	Intermountain maple woodland
	W	955	Misc. western hardwood woodlands
E		**980**	**Tropical Hardwoods Group**
E		981	Sable palm
E		982	Mangrove
E	W	**990**	**Exotic Hardwoods Group**
E		991	Paulownia
E		992	Melaluca
E	W	993	Eucalyptus
E	W	995	Other exotic hardwoods
E	W	999	Non stocked

APPENDIX 5 -- METRIC EQUIVALENTS AND AIDS

Length

1 inch	=	2.54 centimeters (cm.)
0.1 feet	=	3.048 centimeters (cm.)
1 foot	=	0.3048 meter (m.)
1 mile	=	1.609 kilometers (km.)

1 centimeter (cm.)	=	.03 foot (ft.)
1 meter (m.)	=	3.2808 feet (ft.)

Area

1 acre	=	0.4 hectare (ha.) (approximately)
5 acres	=	2 hectares (ha.) (approximately)
1,000 acres	=	404.7 hectares (ha.)
1 hectare	=	2.471 acres (ac.)
2.5 hectares	=	6 acres (ac.) (approximately)

Volume

1,000 cubic feet	=	28.3 meters (m^3)
1 cubic foot per acre	=	0.07 cubic meter per hectare (m^3/ha)

Condition class minimum area

0.4 hectares (1 acre)	=	4,000 square meters
	=	40 meters x 100 meters
	=	35 meter radius circle
1 acre	=	118 foot radius circle
	=	30 feet x 209 feet
	=	43,560 square feet

Basal Area Factor

Metric units: each selected tree represents XX square meters of basal area per hectare
English units: each selected tree represents XX square feet of basal area per acre.

English	Metric
15	3.44
20	4.59
30.5	7
30	6.88

Metric System-length

1 meter	=	10 decimeters (dm.)
1 meter	=	100 centimeters (cm.)
1 meter	=	1,000 millimeters (mm.)

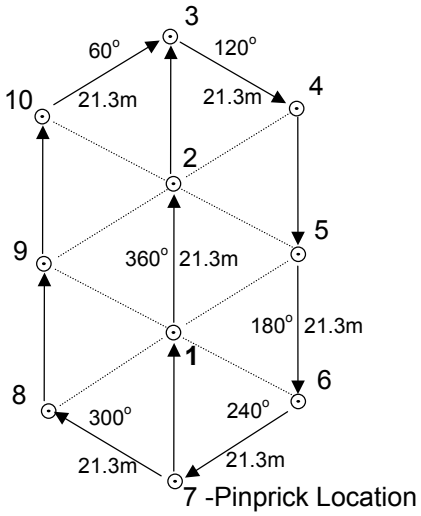
and:

.001 meters	=	1 millimeter
.01 meters	=	1 centimeter
.1 meters	=	1 decimeter
1 meter	=	1 meter
10 meters	=	1 decameter
100 meters	=	1 hectometer
1,000 meters	=	1 kilometer

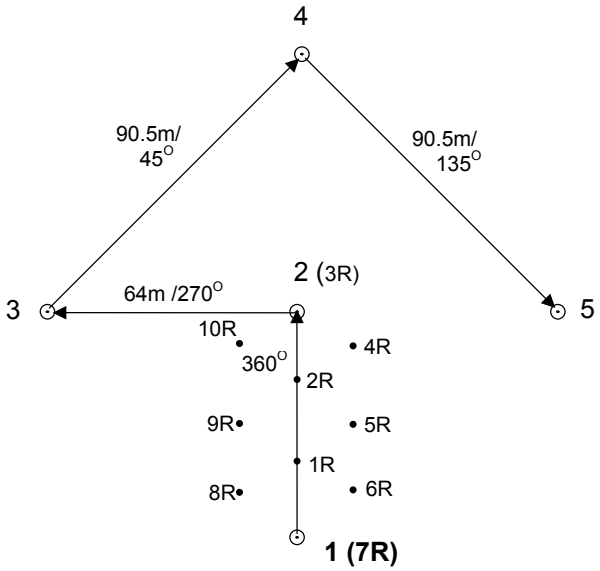
Photo Scales

Scale	Length on Photo	Length on Ground
1:15,840	1 mm.	15.8 meters
1:24,000	1 mm.	24.0 meters
1:31,680	1 mm.	31.7 meters
1:40,000	1 mm.	40.0 meters
1:15,840	1 inch	1,320 feet
	0.1 inch	132 feet
	.05 inch (1/20)	66 feet
1:24,000	1 inch	2,000 feet
	0.1 inch	200 feet
	.05 inch (1/20)	100 feet
1:31,680	1 inch	2,640 feet
	0.1 inch	264 feet
	.05 inch (1/20)	132 feet
1:40,000	1 inch	3,333 feet
	0.1 inch	333 feet
	.05 inch (1/20)	166 feet

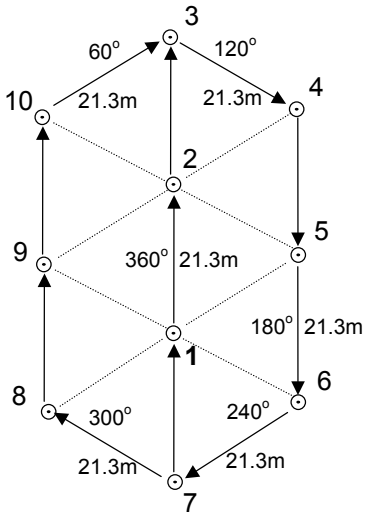
APPENDIX 6 -- OC1 AND OC2 10-POINT PLOT LAYOUT



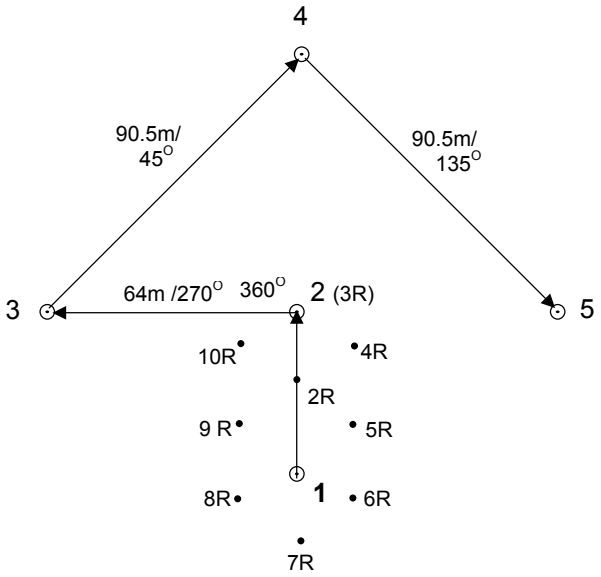
Olympic Unit, Oc1;
21.3m = 70 ft



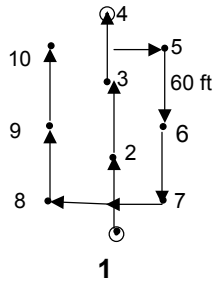
Olympic Unit, Oc2
Point 1 to 2 = 64m (210 ft)



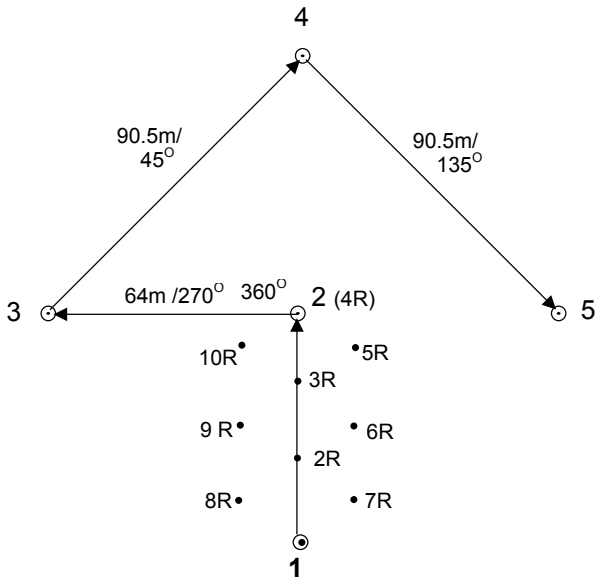
Puget Unit, Oc1
21.3m = 70 ft



Puget Unit, Oc2
Point 1 to 2 = 42.6m (140 ft)



Southwest Unit, Oc1
60 ft between points



Puget Unit, Oc2
Point 1 to 2 = 180 ft

APPENDIX 7 -- HELLO LETTER

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Forestry Sciences Laboratory
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000**

File Code: 4810

Date: Summer 2000

To Whom It May Concern:

Hello, we are researchers from the USDA Forest Service, Pacific Northwest Research Station. We are obtaining information on the forest resources of the Pacific Northwest from measurements taken on a large number of randomly located sample plots on forestland. We are visiting one of these plots in this general vicinity today.

We locate each plot from a sample selected on an aerial photograph. While at the site we record information pertaining to the type of terrain; tree species, heights, and diameters; insect and disease damage; mortality and regeneration; and the amount and kind of understory vegetation. Many of our field plots were first established in the early 1960's and have been revisited on a 10-year cycle.

With the measurements we take, analysts will develop basic information about the amount, condition, and change in the area's forest resource. Published reports contain data on forest land area and ownership, timber volume, forest growth, mortality and cut, potential productivity, and opportunities for silvicultural treatment.

If you are interested in learning more about our research plans, or care to see publications from previous inventories similar to this one, please contact Otha Terry at (503) 808-2044 or Dale Baer at (503) 808-2052 by telephone or by writing to:

Portland Forestry Sciences Laboratory
Forest Inventory and Analysis Program
P. O. Box 3890
Portland, OR 97208-3890

Sincerely,

DALE R. BAER
Team Leader
Forest Inventory and Analysis

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APPENDIX 8 -- LANDOWNER CONTACT LETTER

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Forestry Sciences Laboratory P.O. Box 3890 Portland, Oregon 97208 (503) 808-2000**

File Code: 4810
Date: May 5, 2000

«OWN_NAME»
«ADDRESS_LINE_1»
«ADDRESS_LINE_2»
«ADDRESS_LINE_3»

Dear «OWN_NAME»:

The Pacific Northwest Research Station located in Portland, Oregon is reinventorying forest lands in Washington to gain basic information used by researchers and the public. This information will help answer questions concerning the amount, condition and trends of Washington's forest resources, and is part of a similar national effort across the country.

Data have been collected every 10 years from permanent inventory plots located on a grid across Washington. Most of these inventory plots were originally established in 1963 to 1966 and remeasured in 1977 to 1978 and again in 1988 to 1989. One of our plots falls on your land. The legal description of the location of this plot is Township «TWN», Range «RANGE», Section «SEC», «FORTY». We request your permission to access your land to measure the vegetation on this plot. We only request your permission to access your land. We do not ask you to change your management practices or for your help in taking any measurements.

Data we collect from the plot on your property are combined with other plot data from adjoining areas and counties to provide information about resource conditions in the State of Washington. The data will not be identified in any way with your name or property and will have no bearing on your property taxes. Collected data are summarized, analyzed, and published in statistical and analytical reports for the United States, for Washington alone, and for various geographic areas within Washington and are available to the public.

Our field staff will be in your area between May 1 and October 30. If you wish, they will contact you before entering your land. We realize that working on your land is a privilege and we will respect your landowner rights at all times. We are prepared to honor special conditions that you may impose upon us. Please return the enclosed postcard with your response. If you have any questions regarding the information in this letter please contact Otha Terry at (503) 808-2044 or Dale Baer at (503) 808-2052.

Our program is undergoing numerous changes to match the national inventory effort. Starting in 2001 we will be measuring a portion of our plots (approximately 10 %) each summer rather than measuring all of the plots every 10 years. As the schedule of plot measurement has not yet been determined, we may be contacting you within the next several years to revisit this plot again.

We will be happy to share the resource information we gather from your property should you be interested. Thank you again for your cooperation in this study. Your participation is greatly appreciated.

Sincerely,

SUSAN A. WILLITS
Program Manager
Forest Inventory and Analysis

Enclosure
«COUNTY» County (**«CNTY_CODE»**) Plot **«SECDRY_PLT_ID_IN_CNTY»**

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Forestry Sciences Laboratory P.O. Box 3890 Portland, Oregon 97208 (503) 808-2000**

File Code: 4810

Date:

R E L E A S E

The USDA FOREST SERVICE assumes liability, pursuant to the Federal Tort Claims Act, for any damages caused by negligence of Forest Service personnel while upon the landowner's property in connection with the inventory of forest resources in the State of Oregon, and the landowner shall not be liable for injuries occurring to Forest Service personnel for any reason except the negligent or wrongful acts of the landowner while they are on the property owned or controlled by the landowner.

County _____

Plot Number _____

Landowner _____

SUSAN A. WILLITS
Program Manager
Forest Inventory and Analysis
Pacific Northwest Research Station
US Department of Agriculture

APPENDIX 9 -- GLOSSARY

ACRE:	A UNIT OF LAND CONTAINING 43,560 SQUARE FEET OF AREA. 0.4 HECTARE.
AGE AT BREAST-HIGH	THE NUMBER OF ANNUAL GROWTH RINGS BETWEEN THE BARK AND THE CENTER OF THE TREE AT 4.5 FEET ABOVE THE ROOT COLLAR ON THE BOLE OF A TREE.
ASPECT	THE DIRECTION A SLOPE FACES.
AZIMUTH:	ANGLE OR DIRECTION FROM 1 TO 360 DEGREES. THE AZIMUTH PLUS 180 DEGREES IS THE BACK AZIMUTH.
BASAL AREA:	(A) OF A TREE: THE CROSS SECTIONAL AREA OF A TREE AT BREAST HEIGHT ON THE STEM. (B) OF A FOREST OR STAND: THE CROSS-SECTIONAL AREA AT BREAST HEIGHT OF ALL TREES WITHIN A UNIT OF AREA.
BASAL AREA FACTOR (BAF):	THE BASAL AREA PER UNIT OF AREA CORRESPONDING WITH A GIVEN CRITICAL ANGLE IN VARIABLE-RADIUS PLOT SAMPLING.
BOLE:	TRUNK OR MAIN STEM OF A TREE.
BORDERLINE TREE:	A TREE THAT IS AT OR NEARLY AT THE LIMITING DISTANCE ASSOCIATED WITH A GIVEN BASAL AREA FACTOR. BORDERLINE TREES REQUIRED PRECISE CHECKING TO DETERMINE IF THEY ARE TO BE SAMPLED.
BREAST HEIGHT:	THE STANDARD HEIGHT, 4.5 FEET ABOVE GROUND LEVEL, AT WHICH DIAMETER OF A STANDING TREE OR SNAG IS MEASURED. ON SLOPING GROUND, BREAST HEIGHT IS MEASURED ON THE UPHILL SIDE OF THE BOLE.
CANKER:	LOCALIZED INJURY TO STEM, BRANCH OR ROOT; CAUSED BY DISEASE OR INSECTS.
CANOPY:	THE COVER OF FOLIAGE FORMED BY TREE CROWNS.
CANOPY CLOSURE	THE PERCENTAGE OF GROUND AREA COVERED BY THE VERTICALLY PROJECTED CROSS-SECTIONS OF TREE CROWNS
CENSUS WATER:	PERMANENT AREAS OF WATER MORE THAN 4.5 ACRES OR WIDER THAN 200 FEET.
CHAIN:	A UNIT OF LENGTH 20 METERS LONG (66 FEET).
COARSE WOODY DEBRIS:	DEAD TREE BOLES, LIMBS, AND OTHER WOODY PIECES THAT HAVE BEEN SEVERED FROM THEIR ORIGINAL SOURCE OF GROWTH OR HAVE BEEN UPROOTED. PIECES MUST BE $\geq$5.O IN. IN DIAMETER AT THE POINT OF TRANSECT INTERSECTION,$\geq$3 FEET IN LENGTH, $\geq$5.O IN. IN DIAMETER ALONG THAT LENGTH AND IN DECAY 1 THROUGH 4 TO BE SAMPLED.
CONDITION CLASS	CONDITION CLASS IS DEFINED BY DIFFERENCES IN CONDITION STATUS, OR IN ONE OF THE SIX MAPPING VARIABLES: RESERVED

	STATUS, FOREST TYPE, OWNER GROUP, STAND SIZE, REGENERATION STATUS, AND TREE DENSITY.
CONIFER:	CONE-BEARING TREES, MOSTLY EVERGREENS, WITH NEEDLE OR SCALE-LIKE LEAVES BELONGING TO THE BOTANICAL GROUP GYMNOSPERMAE. ALSO REFERRED TO AS SOFTWOODS.
CONK:	THE FRUITING BODY OF A WOOD-DESTROYING FUNGUS WHICH PROJECTS FROM THE TRUNK, ROOTS OR OTHER TREE PARTS.
CROOK:	ABRUPT BEND OR CURVATURE IN THE BOLE OF A TREE; A CROOK IS A SOUND CULL DEDUCTION FROM GROSS MERCHANTABLE VOLUME.
CROWN:	THE PORTION OF A TREE CARRYING THE MAIN BRANCH SYSTEM AND FOLIAGE.
CROWN CLASS:	THE SOCIAL POSITION OF A TREE RELATIVE TO ITS ABILITY TO RECEIVE DIRECT SUNLIGHT.
CROWN RATIO:	THE PERCENT OF A TREE'S TOTAL HEIGHT WHICH HAS A LIVE CROWN.
CULL:	(A) TREES OR LOGS, OR PORTIONS OF LOGS THAT ARE OF MERCHANTABLE SIZE BUT ARE UNUSABLE FOR INDUSTRIAL WOOD PRODUCTS DUE TO DEFECTS (ROT OR FORM). (B) TO CULL A LOG OR PORTION OF A LOG WITH RESPECT TO GROSS MERCHANTABLE VOLUME (C) THE DEDUCTION MADE FROM GROSS VOLUME OF A TREE OR LOG TO ADJUST FOR SOUND OR ROTTEN DEFECTS.
ROUGH CULL:	PERCENTAGE DEDUCTION OF VOLUME LOST DUE TO BROKEN OR MISSING PARTS, FORKS OR CROOKS.
CULL ROT:	LOSS OF GROSS MERCHANTABLE VOLUME DUE TO ROT. VISUALLY INDICATED BY CONKS, ROTTEN SEAMS, ETC., CODED AS A CATEGORY OF PERCENTAGE OF VOLUME AFFECTED BY THE ROT.
CULTURAL NONFOREST STRINGER:	NONFOREST AREA OF CONSTRUCTED ROADS, RAILROADS, POWER-LINES, PIPELINES, AND CANALS WHICH ARE 1.0 ACRES OR LARGER WITH NO MINIMUM WIDTH REQUIREMENT.
CULTURALLY-KILLED TREE:	A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT SINCE KILLED BY DIRECT HUMAN ACTIVITY AND NOT UTILIZED. THE TREE CAN BE STANDING, DOWNED, OR FELLED. INCLUDED ARE TREES KILLED BY LOGGING INJURY AND STILL STANDING. A TREE IS CULTURALLY-KILLED ONLY IF IT SHOWS NO SIGN OF LIFE OR IS PARTIALLY UPROOTED , LIVE, AND LEANS $\geq$45 DEGREES.
CWD:	SEE COARSE WOODY DEBRIS.
D.B.H.:	DIAMETER BREAST HEIGHT: THE TREE DIAMETER MEASURED AT BREAST HEIGHT--4.5 FEET ABOVE GROUND LEVEL.
DEAD TREE:	A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT NOW DEAD. DEATH WAS NATURAL AND NOT DUE TO DIRECT HUMAN

	ACTIVITY. A TREE IS DEAD ONLY IF IT SHOWS NO SIGH OF LIFE OR IS PARTIALLY UPROOTED, LIVE, AND LEANS ≥45 DEGREES.
DEFOLIATOR:	AN INSECT, WHICH FEEDS UPON, OR STRIPS LEAVES AND NEEDLES FROM TREES.
EVEN-AGED STAND:	A STAND IN WHICH INDIVIDUAL TREES ORIGINATED AT APPROXIMATELY THE SAME TIME. SPECIFICALLY, THE STAND MUST NOT BE CLASSIFIED AS NONSTOCKED, AND AT LEAST 70 PERCENT OF THE LIVE TREES PRESENT MUST BE WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.
FIELD GRID LOCATION:	THE CENTER OF SUBPLOT 1 ON THE STANDARD PLOT LAYOUT. THE FIELD GRID LOCATION IS PINPRICKED ON OC3 PLOT PHOTOS IF THE PLOT WAS VISITED AT OC3; THIS INCLUDES ESTABLISHED PLOTS THAT CAN'T BE FOUND AT OC4. THE FIELD GRID LOCATION IS PINPRICKED ON THE OC4 PHOTOS FOR PLOTS THAT WERE NOT VISITED AT OC3.
FIXED-RADIUS PLOT:	A CIRCULAR SAMPLED AREA WITH A SPECIFIED RADIUS IN WHICH ALL TREES OF A GIVEN SIZE, SHRUBS, OR OTHER ITEMS ARE TALLIED.
FORB:	A BROAD-LEAVED HERBACEOUS PLANT AS DISTINGUISHED FROM GRASSES, SHRUBS AND TREES.
FOREST TYPE:	CLASSIFICATION OF A FOREST SITE BASED ON THE TREE SPECIES PRESENT THAT MOST DOMINANTS THE GROWING SPACE OF THE SITE.
GLC:	GROUND LAND CLASS.
GROUND LAND CLASS:	A CLASSIFICATION OF LAND BY USE. THE MINIMUM AREA FOR CLASSIFICATION IS 1.0 ACRE. EACH MAPPED CONDITION CLASS REQUIRES A GROUND LAND CLASS.
HARDWOODS:	BROAD-LEAVED AND DECIDUOUS TREES AS OPPOSED TO HAVING NEEDLES. TREES BELONGING TO THE BOTANICAL GROUP ANGIOSPERMAE. TREE SPECIES CODES >299.
HARVESTED TREE:	A TREE TALLIED OR RECONSTRUCTED AS LIVE AND >5.O IN. D.B.H. AT OC3BUT SINCE HARVESTED FOR INDUSTRIAL SUPPLY, FIREWOOD, LOCAL USE, OR INCIDENTAL REASONS.
HEARTWOOD:	THE INNER, NONLIVING CORE OF WOOD IN A TREE BOLE, GENERALLY DARKER THAN SAPWOOD.
HECTARE:	A METRIC UNIT OF AREA EQUAL TO 10,000 SQUARE METERS. 2.47 ACRES.
INCREMENT:	THE INCREMENT IN D.B.H. OF A TREE IN A SPECIFIED PERIOD OF TIME.
INGROWTH TREE:	A TREE THAT HAS GROWN PAST A DIAMETER THRESHOLD ON A FIXED-RADIUS PLOT SINCE PREVIOUS INVENTORY.

LIMITING DISTANCE:	THE SET OF DISTANCES FOR A SPECIFIED BASAL AREA FACTOR WHICH DETERMINES WHETHER A TREE IS IN OR OUT OF THE SAMPLE. THE DISTANCE IS THE PRODUCT OF THE TREE'S DBH MULTIPLIED BY THE PLOT RADIUS FACTOR. THE PLOT RADIUS FACTOR IN WESTERN OREGON IS 1.57465.
MAI:	MEAN ANNUAL INCREMENT. MAI IS THE AVERAGE ANNUAL GROWTH OF A FULLY STOCKED STAND AT A SPECIFIED AGE.
MORTALITY TREE:	SEE DEAD TREE.
MYCELIUM:	THE VEGETATIVE PART OF A FUNGUS; A MASS OF THREAD-LIKE FILAMENTS.
NONFOREST INCLUSION:	AN AREA THAT IS NONFOREST BUT LESS THAN 1.0 ACRE IN SIZE. WHEN PART OR ALL OF A FIXED OR VARIABLE-RADIUS PLOT FALLS WITHIN A NONFOREST INCLUSION, THE INCLUSION IS SAMPLED AS PART OF THE SURROUNDING FOREST LAND.
NONSTOCKABLE:	A FOREST LAND CONDITION CLASS IS NONSTOCKED IF: 1) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS <5.O IN.. D.B.H. AND <100 FREE-TO-GROW SEEDLINGS AND SAPLINGS PER ACRE ARE DISTRIBUTED BROADLY ACROSS THE CONDITION CLASS. OR: 2) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS ≥5.0 IN. D.B.H. AND TREE CANOPY COVER IS < 10 PERCENT. OR: 3) THE CONDITION CLASS WAS RECENTLY CLEARCUT AND HAS NOT BEEN REPLANTED.
Oc1:	THE INVENTORY OF 1963 (SOUTHWEST UNIT), 1965 (OLYMPIC PENINSULA) AND 1966 (PUGET SOUND).
Oc2:	THE INVENTORY OF 1978-79.
Oc3 :	THE INVENTORY OF 1988-89.
Oc4:	THE CURRENT INVENTORY.
PASTURE:	PASTURE IS RANGELAND THAT HAS BE PLOWED AND ARTIFICIALLY SEEDED TO GRASS OR OTHER FORAGE SPECIES LIKE CLOVER TO FEED DOMESTIC LIVESTOCK. OFTEN, IT IS IRRIGATED AND FENCED.
PC:	PLOT CENTER. THE FIELD GRID LOCATION ON THE GROUND FOR EACH FIELD PLOT. ON ESTABLISHED PLOTS VISITED AT OC3, PLOT CENTER IS AT THE OC3 CEDAR STAKE. ON MISSING OR LOST PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC3 PLOT PHOTOS. ON NEW PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC4 PLOT PHOTOS.
PI:	PHOTO INTERPRETATION.
POLETIMBER:	A TREE 5.0 TO 8.9 IN. D.B.H.
POLETIMBER STAND	A STAND IN WHICH THE AVERAGE DIAMETER OF THE TREES PRESENT IS 5.0 TO 8.9 in. D.B.H.

PLANT INDICATOR	A PLANT SPECIES USED IN PREDICTING THE STOCKING CAPACITY OF A FOREST LAND SITE.
RANGELAND:	LAND DOMINATED BY NATURAL PLANT COVER COMPOSED PRINCIPALLY OF NATIVE OR EXOTIC GRASSES, FORBS, OR SHRUBS. NATURAL RANGELAND IS UNIMPROVED, I.E., IT IS NOT IRRIGATED, AND HAS NOT BEEN SEEDED ARTIFICIALLY.
REGENERATION:	A YOUNG, PRECOMMERCIAL-SIZED STAND, OR THE UNDERSTORY TREE COMPONENT OF A MULTISTORIED STAND.
RELEASE:	FREEING A TREE FROM IMMEDIATE COMPETITION BY REMOVING OTHER TREE OR NONTREE COMPETITION.
RESIDUAL OVERSTORY:	A TREE THAT HAS SURVIVED FROM THE PREVIOUS STAND AND IS USUALLY LARGER OR OLDER THAN TREES WHICH ORIGINATED AS PART OF THE PRESENT STAND.
ROT:	DECAY. DECOMPOSITION OF WOOD BY FUNGI OR BACTERIA.
ROUNDWOOD:	SECTIONS OF TREE STEMS, WITH OR WITHOUT BARK. INCLUDES LOGS, BOLTS, POSTS, PILINGS AND OTHER PRODUCTS STILL "IN THE ROUND".
RP:	REFERENCE POINT. AN OBJECT (USUALLY A TREE) WHICH CAN BE LOCATED ON THE GROUND AND IDENTIFIED ON THE PHOTO. IT WILL BE TAGGED AND REFERENCED TO THE CEDAR STAKE IN ORDER TO FACILITATE RELOCATING THE PLOT.
SAPLING:	A TREE 1.0 TO 4.9 IN. D.B.H.
SAPWOOD:	THE OUTER LAYERS OF WOOD BETWEEN THE HEARTWOOD AND INNER BARK. GENERALLY LIGHTER IN COLOR THAN HEARTWOOD.
SAWTIMBER STAND, SMALL	A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS 9.0 TO 21.0 IN. D.B.H.
SAWTIMBER STAND, LARGE	A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS GREATER THAN 21.0 IN. D.B.H.
SDI	STAND DENSITY INDEX.
SEEDLING:	A LIVE TREE LESS THAN 1.0 IN. D.B.H. THAT IS AT LEAST 0.5 FEET IN HEIGHT (CONIFERS) OR 1.0 FEET IN HEIGHT (HARDWOODS) AND ESTABLISHED IN MINERAL SOIL.
SEEDLING-SAPLING STAND	A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS LESS THAN 5.O IN. D.B.H.
SILVICULTURE:	THE SCIENCE AND PRACTICE OF GROWING AND TENDING FOREST CROPS FOR SPECIFIED OBJECTIVES.
SITE:	THE AGGREGATE OF ALL ENVIRONMENTAL CONDITIONS AFFECTING THE SURVIVAL AND GROWTH OF A PLANT COMMUNITY ON A SPECIFIC AREA.

SITE CLASS:	A CLASSIFICATION OF POTENTIAL AVERAGE ANNUAL ABILITY OF A FOREST LAND SITE TO PRODUCE WOOD--FOR THE PERIOD BETWEEN THE TIME OF STAND ESTABLISHMENT AND THE TIME WHEN AVERAGE ANNUAL WOOD PRODUCTION PEAKS-- WERE THE SITE FULLY STOCKED WITH DESIRABLE TREES.
SITE INDEX:	A MEASURE OF PRODUCTIVITY INHERENT ON A FOREST SITE THAT IS SIMPLE NUMERICAL VALUE BASED UPON TREE HEIGHT AT A SPECIFIED AGE.
SNAG:	A STANDING DEAD TREE. IN THE CURRENT INVENTORY, A SNAG MUST BE ≥5.O IN. DBH AND ≥4.5 FEET TALL, AND HAVE A BOLE WHICH DOES NOT TOUCH THE GROUND. A SNAG MAY BE EITHER SELF-SUPPORTED BY ITS ROOTS, OR SUPPORTED BY ANOTHER TREE OR SNAG.
SOFTWOODS:	CONIFEROUS TREES, USUALLY EVERGREEN, HAVING NEEDLE OR SCALE-LIKE LEAVES.
STAND AGE:	THE TOTAL AGE OF A FOREST STAND THAT BEST CHARACTERIZED THE STAND. STANDS ARE EVEN- OR UNEVEN-AGED.
STANDING DEAD TREE:	SEE SNAG.
STAND DENSITY INDEX:	THE MAXIMUM NUMBER OF TREES PER UNIT AREA A FOREST SITE WILL SUPPORT WHEN THE STAND D.B.H. IS 10 INCHES RELATIVE TO THE MAXIMUM EXPECTED NUMBER IF THE SITE WERE CAPABLE OF SUPPORTING A NORMAL STAND.
STAND SIZE:	A CLASSIFICATION OF STANDS BASED ON TREE SIZE. STAND SIZES ARE LARGE SAWTIMBER, SMALL SAWTIMBER, POLETIMBER, AND SEEDLING-SAPLING STANDS. IF LESS THAN 10 PERCENT STOCKED WITH LIVE TREES, THE SITE IS CALLED NONSTOCKED.
STOCKABILITY INDICATOR:	A PLANT SPECIES OR ABIOTIC ATTRIBUTE USED TO PREDICT THE STOCKING CAPACITY OF A FOREST SITE.
STOCKABILITY PROBLEM:	A FOREST SITE NOT CAPABLE OF SUPPORTING THE TREE DENSITY EXPECTED IF THE SITE COULD SUPPORT A NORMAL, FULLY STOCKED STAND.
STOCKING:	A QUALITATIVE EXPRESSION BASED ON COMPARING THE EXISTING NUMBER OF TREES PRESENT ON A FOREST SITE TO THE NUMBER NEEDED TO ACHIEVE THE MOST OPTIMAL GROWTH, VOLUME, OR VALUE POSSIBLE ON THE SITE.
SUNSCALD:	DAMAGE TO THE CAMBIUM CAUSED BY OVEREXPOSURE TO SUN.
SWEEP:	A BROAD ARC IN A BOLE OR LOG. A SOUND CULL DEFECT.
TERMINAL LEADER:	THE TOPMOST SHOOT OF A TREE.
TRACHEID:	PART OF WOOD STRUCTURE: A LONG, TUBELIKE CELL IN WOOD TISSUE.

TRACKABLE TREE: A SAMPLED TREE THAT IS REFERENCED AND REMEASURED IN SUCCESSIVE INVENTORIES ON PERMANENT PLOTS.

TREE A TREE IS A WOODY PLANT THAT HAS AN ERRECT PERENNIAL STEM OR TRUNK AT MATURITY THAT IS AT LEAST 3.0 IN. DIAMETER AT BREAST HEIGHT (4.5 FEET) AND A TOTAL HEIGHT OF AT LEAST 12 FEET. (Ag. Handbook No. 541, 1979, ed., p. 3).

UNEVEN-AGED STAND: A STAND THAT IS NOT CLASSIFIED AS NONSTOCKED AND THAT HAS LESS THAN 70 PERCENT OF THE TREES PRESENT WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.

VARIABLE-RADIUS PLOT: A PLOT ON WHICH TREES ARE SELECTED FOR MEASUREMENT ACCORDING TO SIZE RATHER THAN BY THE FREQUENCY OF THEIR OCCURRENCE. THE LARGER THE DIAMETER OF A TREE THE FARTHER FROM PLOT CENTER IT CAN BE AND STILL BE SAMPLED.

WILT: DROOPING OF FOLIAGE; OFTEN A DISEASE SYMPTOM.

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APPENDIX 10 -- CHECK PLOTS

A. Objectives: Check plots are performed for several purposes:

1. To assess the accuracy of collected data;

2. To ensure that documented field plot instructions and accuracy standards are uniformly understood and consistently followed;

3. To assess the ability of individual crew members.

B. Check plot policies: The following policies for conducting check plots will be followed:

1. Each person will be checked within the first two weeks of field work and will accompany the checkplotter to the check plot.

2. Check plots will continue during the entire season; each person is checked 4-5 times during the field season.

3. All check plot items count equally for each person who did the plot.

C. Check plot procedures:

1. In the field, the check plotter checks all tree classifications and measurements. The check plotter or one of the crew members who originally did the plot makes all of the tree measurements during the check plot visit . These check measurements are compared to the original measurements recorded on the data recorder hardcopy. Items that do not meet accuracy standards are rechecked. Final decisions on accuracy rest with the check plotter. Errors are circled in red on the original tally sheet, and the correct value written near the circle.

2. Completing the check plot form. Field plot items are organized into categories on the check plot form. The percent correct in each of the categories is calculated by dividing the number of correct items by the total number of items.

Each category is rated as (1) outstanding, (2) acceptable, or (3) unacceptable. These ratings are based on the accuracy standards indicated on the check plot form.

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APPENDIX 11 -- CHECK PLOT FORMS

County _____ Plot #_____ Crew_____ Date_____

Checked by_____ Date_____

1. PLOT LOCATION

To receive Outstanding:
(A) If remeasured, the plot must be relocated. (B) If new, the plot must be within type and +/- 15 ft. (C) Total = 100%

To receive Acceptable:
(A) If remeasured, the plot must be relocated, or (B) If new, the plot must be within +/- 30 ft.
(C) Total ≥90%

	# Correct/Out of
a.) Remeasured-relocated	_____
b.) New-correctly located +/- 30 ft.	_____
c.) Oc 3, and 4 pinpricks in same correct spot (+/- 30ft) labeled . . .	_____
d.) RP tagged, pinpricked, labeled and described	_____
e.) RP azimuth +/- 4 degrees, distance +/- 5%	_____
f.) Plot must be findable 10 yrs from now (judgment of checkers) . .	_____
Total	_____ _____%

2. PLOT LAYOUT

To receive Outstanding:
(A) All subplots correctly numbered, and (B) All condition class boundaries correctly drawn, and (C) Total = 100%

To receive Acceptable:
(A) Total ≥95%

	# Correct/Out of
a.) Subplots correctly numbered	_____
b.) Diagram accurate, condition class boundaries correct	_____
c.) References tagged, recorded, appropriately selected	_____
d.) Reference Az +/- 4 degrees, distances +/-.2 ft. (8 per subplot) . . .	_____
Total	_____ _____%

3. TRACKABLE TREE PRISM TALLY

To receive Outstanding:100% To receive Acceptable: ≥98%

	# Correct/Out of
a.) Prism tally	_____
Total	_____ _____%

4A. TRACKABLE TREE FIXED-RADIUS TALLY: SAPLINGS

To receive Outstanding: 100% To receive Acceptable: ≥98%

	# Correct/Out of	
a.) Fixed radius tally	_____	
Total	_____	_____%

4B. TRACKABLE TREE FIXED-RADIUS TALLY: SEEDLINGS

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of	
a.) Fixed-radius tally	_____	
b.) Selection rules followed	_____	
Total	_____	_____%

5. SITE TREE SELECTION and PLANT ASSOCIATION

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of	
a.) Site tree selection fits model for each tree	_____	
b.) Site average +/- 20 (+/- 30 for 100 year tables)	_____	
c.) Plant association correctly classified	_____	
Total	_____	_____%

6. TREE HISTORY AND SPECIES

To receive Outstanding: 100% To receive Acceptable: ≥98%

	# Correct/Out of	
a.) Tree condition class and history	_____	
b.) Tree species	_____	
Total	_____	_____%

7. HEIGHT AND DBH-TRACKABLE TREES

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥88%

	# Correct/Out of	
a.) Height normally formed up to 60 ft. tall +/- 5%	_____	
b.) Height normally formed >60 ft. tall +/- 10%	_____	
c.) Dbh +/- 0.1 in. per 20 in.	_____	
Total	_____	_____%

8. SNAG TALLY

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of
a.) Snag tally	_____
b.) Dbh decay class 1, 2 +/- 5%; decay class 3,4,5, +/- 10%	_____
c.) Height-same as trees	_____
d.) Use or disappearance correct	_____
e.) Decay class +/- 1 class	_____
Total	_____ _____%

9. CONDITION CLASS

To receive Outstanding:100% To be acceptable: ≥95%
To receive Outstanding or Acceptable (a) and (e) must be 100%

	# Correct/Out of
a.) Condition class correctly recognized	_____
b.) Condition classes mapped on 55.8 ft. subplot diag. correctly	_____
c.) Az. +/- 4 degrees; Distances +/- 2 ft. to distinct boundary	_____
d.) Percent of subplot in each condition class +/- 5%	_____
e.) Condition Status of each condition class	_____
f.) Reserved Status, Owner Group, Forest Type	_____
g.) Stand Size, Regeneration Status, Tree Density	_____
h.) Stand age, Stand Condition	_____
Total	_____ _____%

10. TREE IDENTIFICATION AND CLASSIFICATION

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of
a.) Height estimates in trees with missing parts +/- 6 ft.	_____
b.) Dbh nail height +/- 1 in., 2 or more nails in 30+ in. trees	_____
c.) Age-bored +/- 2 yr, estimated +/- 10%	_____
d.) Crown ratio +/- 1 class	_____
e.) Crown class: free to grow or not*	_____
f.) PNW Damaging agent in correct group or harvest code correct	_____
g.) Mistletoe recognized	_____
h.) Cull Other +/- 10%	_____
i.) Form class first 8 ft. log straight or not**	_____
j.) Cull rot indicators correct	_____
Total	_____ _____%

* For crown class crew will be marked off if they do not correctly distinguish between dominant-codominant and intermediate-suppressed trees.

** For form class crew will be marked off if they do not correctly recognize that the first 8 ft. log of the tree is straight or not.

11. VEGETATION PROFILE PLOT CLASSIFICATION

To receive Outstanding*: ≥95% To receive Acceptable: >90%

	# Correct/Out of
a.) Tree, shrub and perennial grass species recognized*	_____
b.) Forb, annual grass species recognized	_____
c.) Top 5 cover shrub/herb/grass listed in relative frequency order	_____
d.) Total shrub/herb/grass percent +/- 20%	_____
e.) Vegetation layer and stage of development correct	_____
f.) % bare ground +/- 20%	_____
g.) Total veg percent cover +/- 20%	_____
Total	_____ _____%

* To receive an Outstanding item a) must be ≥ 98%

12. AREA CLASSIFICATION

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of
a.) Stream proximity +/- 5 %, stream class correct	_____
b.) Aspect +/- 20	_____
c.) Slope +/- 20%.	_____
d.) Physiographic class	_____
e.) Nonstockable, root rot-recognized +/- 15%	_____
f.) Plot description-land class, productivity, treatment, disease, layout, harvest, ownership class, etc addressed	_____
Total	_____ _____%

13. COARSE WOODY DEBRIS

To receive Outstanding: ≥95% To receive Acceptable: <95% and ≥90%

	# Correct/Out of
a.) Piece tally	_____
b.) Intersection diameter; decay class 1, 2, 3 +/- 1 in.	_____
decay class 4 +/- 2 in.	_____
c.) Large and small end diameters +/- 2 in.	_____
d.) Decay Class +/- 1 class	_____
e.) Piles (shape code)	_____
f.) Length--same standards as tally trees	_____
Total	_____ _____%

14. OTHER ITEMS NOT PREVIOUSLY COVERED (if needed-checker's decision)

To receive Outstanding: 100% To be Acceptable ≥95%

	# Correct/Out of
a.)	_____
b.)	_____
c.)	_____
Total	_____ _____%

CHECK PLOT SUMMARY

OUTSTANDING CATEGORIES	ACCEPTABLE CATEGORIES	UNACCEPTABLE CATEGORIES

WRITE-UP_____

_____

_____

_____

_____

_____

_____

_____

.

APPENDIX 12 -- INSECT AND DISEASE KEYS

Root Disease Identification Aids:

General root disease symptoms
Root disease centers or "pockets" usually appear as patches or groups of dead and dying trees. Trees in all stages of decline--long-dead trees, recent kills, declining live trees--are usually present; old dead trees are found at the center of the pocket, while declining trees occur near the leading edge of the expanding infected area; in contrast, bark beetle group kills usually consist of trees that died suddenly and simultaneously. Wind thrown trees with decayed roots broken off close to the root collar (root ball) may be evident, except for Black stain root disease and Annosus in pines, which do not form root balls. Individual trees affected by root disease may exhibit the following above-ground symptoms:

1. Reduced height growth increment (as compared to neighboring healthy trees). This results from gradual decline as the root system is slowly destroyed. Look for progressively short internodes of the terminal leader.

2. Sparse, yellow crowns. Trees infected by root disease fungi often lose needles; needles that remain are often yellow (chlorotic). The crown appears "transparent".

3. Distress cone crop. In the later stages of decline, infected trees may produce an abundant crop of unusually small cones.

Individual disease descriptions:
Laminated root disease
Affects all conifers to varying degrees. the most susceptible species are Douglas-fir, true-fir, and mountain hemlock. Wind thrown trees have decayed roots broken close to root collar, forming root balls. When duff and soil are removed to expose roots, look for grey-white mycelium on surface of roots; these mycelium penetrate only the outermost few millimeters of bark, forming a crusty sheath that cannot be rubbed off easily. In comparison--Armillaria will have white mycelium on the inside of roots, between the bark and wood.

Laminated root rot is most easily identified by examining decayed wood which can be found on root balls or in stump hollows. Decayed wood separates readily along annual tree growth rings, hence the name "laminated" root rot. Yellowish-brown decayed wood is usually dry and contains numerous 1 millimeter-long oval pits. Reddish-brown wiry whiskers can usually be found between layers of decayed wood and are best seen with a 10x magnifying lens. These whiskers are the best diagnostic indicator of laminated root rot.

Armillaria root disease
Affects all conifers and hardwoods. Root balls on fallen trees may occur in disease centers. Heavy resin flow near base of tree is common. Chopping into root collar or root will reveal white, fan-shaped mats of mycelium between wood and bark. The mats have a texture that may remind one of peeling partially-dry latex paint off a glass surface (if one has ever done that). The mycelium can penetrate a few millimeters into the inner bark, but never evident on the outside of the bark or root surfaces. In comparison, laminated root rot has grey-white mycelium on the outside. Decay in root balls and stumps is soft, spongy, yellowish, usually wet, stringy, and often contains numerous black lines. Honey-colored mushrooms may be present at the base of infected trees and stumps. Black thread-like structures (rhizomorphs) may be present in decaying wood or in infected roots.

Black stain root disease
Pines are the primary host in eastern Oregon. Hemlocks and Douglas-fir can also be affected. Infected trees occasionally have resin flow at the base. Brown to black streaks in the sapwood--usually in the last 3 to 4 annual rings--of the root collar and roots are the best indication of the disease. You must chop into the wood to diagnose Black stain; it does not occur in or on the bark or bole of roots. Root balls are not present in Black stain disease centers (unless an other root disease is present) because the fungus does not rot roots--it plugs sapwood tracheids causing trees to die standing. Black stain is most common in young plantations.

Annosus root disease
Most common on true firs, pine, and hemlock. Most difficult to identify of the major root diseases. Look for groups of trees that have not died all at the same time. Bark beetles usually will be present, especially in true fir, ponderosa pine, and sugar pine. Root balls may be present in disease centers, particularly in true fir stands. In true firs, the decayed wood is soft, spongy, white (often with silvery cast) with black flecks (like small wild rice grains scattered through the decay). Small bracket-shaped conks may be present in stump hollows or under the duff near the root collar of infected dead trees or stumps. Annosus is often identified by default--if it is not one of the other root diseases, and if the symptoms suggest root disease and the decay is similar to the description, then it is probably Annosus. In pines, small "button" conks may be present on the root collar beneath the duff. The roots of infected pines are usually resin-soaked.

Listing of disease-tolerant species by root disease:

Root disease	Disease-tolerant species:
Laminated root rot	larch, pines, cedars
Armillaria root disease	larch, lodgepole pine. On a few sites, ponderosa pine may be susceptible. If this is the case, only larch and lodgepole should be considered tolerant.
Annosus root disease	On sites with abundant true fir, lodgepole and ponderosa pines are tolerant. On ponderosa pine sites, larch and Douglas-fir are tolerant.

Insert unnumbered (color?) insect and disease identification pages here. ???

APPENDIX 13 -- TREE VOLUME TABLES

Species..... WESTERN HEMLOCK (Tsuga Heterophylla)
Unit of measure..... Board-foot
Variables..... D.b.h. and total height
Log rule..... Scribner
Scaling length for logs. 16 feet
Stump height..... 2 feet
Top d.i.b..... 8 inches
Trim allowance per log. 0.3 feet
Method..... Alinement chart
Number of trees..... 1,461
Location of trees..... Young and old stands in Oregon and Washington
Accuracy..... Aggregate deviation 0.06 percent low
Author..... W.H.Meyer, Pacific Northwest Forest and Range Expt. Sta.
Source..... Table 48 in U. S. Dept. Agr. Tech. Bul. 544
Year..... 1937
Note..... Values for odd d.b.h.'s added in 1953

D.b.h. (inches)	Volume in tens of board-feet when total height of tree in feet is--																			
	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
12	8	10	12	14	15	17	19	20	22	23	24	26	----	----	----	----	----	----	----	----
13	10	12	15	17	19	21	23	25	27	29	30	33	----	----	----	----	----	----	----	----
14	12	15	18	20	23	25	27	30	32	35	37	40	----	----	----	----	----	----	----	----
15	14	17	21	24	27	30	32	35	38	41	44	47	----	----	----	----	----	----	----	----
16	17	20	24	28	32	35	38	41	44	48	52	55	59	63	67	----	----	----	----	----
17	19	23	28	32	37	40	44	47	51	56	59	63	67	72	77	----	----	----	----	----
18	22	27	32	37	42	46	50	54	58	64	67	71	76	82	88	----	----	----	----	----
19	25	30	36	41	47	52	56	61	65	71	75	79	84	91	97	----	----	----	----	----
20	28	34	40	46	52	58	63	68	73	79	83	87	93	100	107	113	118	----	----	----
21	----	38	44	51	58	64	70	75	81	87	92	97	103	109	116	122	128	----	----	----
22	----	42	49	56	64	71	77	83	90	96	101	107	113	119	125	132	138	----	----	----
23	----	----	54	62	70	77	84	91	98	105	111	117	124	130	137	144	150	----	----	----
24	----	----	60	68	76	84	92	99	107	114	121	128	135	142	150	157	163	----	----	----
25	----	----	----	74	82	91	100	108	116	124	131	139	147	155	165	172	178	----	----	----
26	----	----	----	80	89	98	108	117	125	134	142	150	159	168	180	187	194	----	----	----
27	----	----	----	----	96	106	116	126	135	144	153	162	172	182	194	203	210	----	----	----
28	----	----	----	----	104	114	124	135	145	155	165	175	186	197	209	222	227	----	----	----
29	----	----	----	----	112	122	132	144	155	166	177	188	199	211	224	235	244	----	----	----
30	----	----	----	----	120	130	141	153	165	177	189	201	213	225	239	250	262	----	----	----
31	----	----	----	----	127	138	150	163	175	188	201	209	227	240	254	266	279	----	----	----
32	----	----	----	----	135	147	160	173	186	200	214	218	241	255	270	282	296	310	324	----
33	----	----	----	----	----	155	169	183	198	207	227	237	256	271	286	300	314	329	343	----
34	----	----	----	----	----	163	178	194	210	215	240	256	271	287	303	318	333	348	363	----
35	----	----	----	----	----	----	----	205	221	232	254	271	287	303	319	335	351	366	382	----
36	----	----	----	----	----	----	----	216	233	250	268	286	303	319	336	353	370	385	401	----
37	----	----	----	----	----	----	----	----	246	264	283	301	319	335	354	371	389	405	421	----
38	----	----	----	----	----	----	----	----	259	278	298	316	336	352	372	390	408	425	442	----
39	----	----	----	----	----	----	----	----	271	291	312	331	351	370	389	408	427	444	462	----
40	----	----	----	----	----	----	----	----	283	304	326	347	367	387	407	427	446	464	483	503
41	----	----	----	----	----	----	----	----	296	318	341	363	383	403	426	446	465	484	504	526
42	----	----	----	----	----	----	----	----	310	332	356	379	400	420	445	465	485	505	525	550
43	----	----	----	----	----	----	----	----	323	349	371	394	417	437	462	482	505	527	547	572
44	----	----	----	----	----	----	----	----	337	367	387	410	435	455	480	500	525	550	570	595
45	----	----	----	----	----	----	----	----	350	378	401	425	450	472	497	520	545	570	592	617
46	----	----	----	----	----	----	----	----	363	390	415	440	465	490	515	540	565	590	615	640
47	----	----	----	----	----	----	----	----	376	405	430	457	482	507	535	560	585	612	637	665
48	----	----	----	----	----	----	----	----	390	420	445	475	500	525	550	580	605	635	660	690
49	----	----	----	----	----	----	----	----	402	432	460	490	517	545	575	600	625	655	682	712
50	----	----	----	----	----	----	----	----	415	445	475	505	535	565	595	620	645	675	705	735
51	----	----	----	----	----	----	----	----	----	----	490	522	552	582	612	640	667	697	727	760
52	----	----	----	----	----	----	----	----	----	----	505	540	570	600	630	660	690	720	750	785
53	----	----	----	----	----	----	----	----	----	----	522	557	587	617	650	680	712	742	775	810
54	----	----	----	----	----	----	----	----	----	----	540	575	605	635	670	700	735	765	800	835
55	----	----	----	----	----	----	----	----	----	----	555	590	622	652	690	720	755	787	822	860
56	----	----	----	----	----	----	----	----	----	----	570	605	640	670	710	740	775	810	845	885
57	----	----	----	----	----	----	----	----	----	----	585	622	657	690	730	762	797	832	870	907
58	----	----	----	----	----	----	----	----	----	----	600	640	675	710	750	785	820	855	895	930
59	----	----	----	----	----	----	----	----	----	----	615	655	692	725	767	802	837	875	912	955
60	----	----	----	----	----	----	----	----	----	----	630	670	710	740	785	820	855	895	930	980

Species................. DOUGLAS-FIR (*Pseudotsuga menziesii*), young-growth
Unit of measure......... Board-foot
Variables............... D.b.h. and total height
Log rule................ Scribner
Scaling length for logs. 16 feet
Stump height............ 2 feet
Top d.i.b............... 8 inches
Trim allowance per log.. 0.3 feet
Method.................. Board-feet per cubic-foot ratios applied to table 12 in U. S. Dept. Agr. Tech. Bul. 201
Number of trees......... 1,434
Location of trees....... Western Oregon and western Washington
Accuracy................ Aggregate deviation 0.1 percent high
Author.................. R. E. McArdle, Pacific Northwest Forest and Range Expt. Sta.
Source.................. Table 14 in U. S. Dept. Agr. Tech. Bul. 201
Year.................... 1930

D.b.h. (inches)	Board-foot volume when total height of tree in feet is--																			
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
12	32	50	69	87	105	124	140	155	176	196	225	-----	-----	-----	-----	-----	-----	-----	-----	-----
13	39	61	83	107	130	150	170	190	212	238	270	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	47	74	101	129	155	175	201	225	252	282	318	354	-----	-----	-----	-----	-----	-----	-----	-----
15	-----	88	118	148	180	207	233	262	290	324	364	410	-----	-----	-----	-----	-----	-----	-----	-----
16	-----	102	136	170	205	235	265	296	330	368	410	466	-----	-----	-----	-----	-----	-----	-----	-----
17	-----	115	154	193	230	263	296	331	370	412	460	522	584	-----	-----	-----	-----	-----	-----	-----
18	-----	-----	174	215	257	294	329	367	410	460	510	580	640	714	-----	-----	-----	-----	-----	-----
19	-----	-----	192	239	283	325	363	403	450	508	564	640	710	782	858	-----	-----	-----	-----	-----
20	-----	-----	213	262	311	355	397	440	494	558	618	694	774	854	942	1,032	-----	-----	-----	-----
21	-----	-----	-----	285	338	388	438	480	538	608	676	754	844	930	1,026	1,122	-----	-----	-----	-----
22	-----	-----	-----	309	367	420	470	520	584	658	732	820	914	1,010	1,114	1,222	-----	-----	-----	-----
23	-----	-----	-----	-----	397	455	507	562	630	708	788	882	986	1,090	1,204	1,322	1,438	-----	-----	-----
24	-----	-----	-----	-----	426	489	545	607	676	758	848	950	1,058	1,172	1,296	1,422	1,548	1,670	-----	-----
25	-----	-----	-----	-----	458	524	584	648	724	811	909	1,018	1,134	1,257	1,393	1,527	1,667	1,801	-----	-----
26	-----	-----	-----	-----	492	562	626	692	770	866	971	1,088	1,210	1,346	1,495	1,645	1,794	1,938	-----	-----
27	-----	-----	-----	-----	524	598	666	728	821	920	1,034	1,158	1,287	1,435	1,597	1,757	1,921	2,075	-----	-----
28	-----	-----	-----	-----	-----	638	708	782	870	975	1,096	1,230	1,368	1,535	1,699	1,874	2,048	2,215	-----	-----
29	-----	-----	-----	-----	-----	674	750	828	920	1,032	1,162	1,304	1,450	1,627	1,803	1,989	2,180	2,354	-----	-----
30	-----	-----	-----	-----	-----	712	792	876	972	1,088	1,228	1,379	1,536	1,720	1,909	2,104	2,308	2,497	-----	-----
31	-----	-----	-----	-----	-----	-----	836	922	1,023	1,148	1,296	1,454	1,622	1,813	2,014	2,222	2,436	2,635	-----	-----
32	-----	-----	-----	-----	-----	-----	878	970	1,076	1,207	1,366	1,529	1,711	1,906	2,100	2,340	2,569	2,778	3,019	3,246
33	-----	-----	-----	-----	-----	-----	922	1,016	1,129	1,267	1,434	1,601	1,797	1,999	2,226	2,458	2,702	2,921	3,180	3,424
34	-----	-----	-----	-----	-----	-----	964	1,060	1,182	1,327	1,512	1,694	1,880	2,092	2,333	2,576	2,833	3,084	3,338	3,598
35	-----	-----	-----	-----	-----	-----	-----	1,112	1,238	1,387	1,565	1,747	1,964	2,180	2,439	2,694	2,963	3,227	3,496	3,780
36	-----	-----	-----	-----	-----	-----	-----	1,158	1,291	1,447	1,628	1,818	2,046	2,278	2,544	2,812	3,096	3,370	3,657	3,956
37	-----	-----	-----	-----	-----	-----	-----	1,208	1,347	1,510	1,692	1,889	2,128	2,372	2,651	2,931	3,225	3,514	3,818	4,132
38	-----	-----	-----	-----	-----	-----	-----	1,256	1,401	1,575	1,753	1,962	2,208	2,465	2,759	3,049	3,358	3,657	3,981	4,315
39	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,814	2,035	2,286	2,558	2,867	3,167	3,491	3,800	4,136	4,488
40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,874	2,106	2,362	2,651	2,970	3,280	3,619	3,943	4,299	4,667
41	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,932	2,176	2,437	2,746	3,068	3,398	3,752	4,086	4,459	4,844
42	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,990	2,244	2,513	2,839	3,168	3,516	3,885	4,229	4,622	5,022
43	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,045	2,310	2,586	2,932	3,266	3,632	4,018	4,372	4,781	5,200
44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,101	2,375	2,659	3,011	3,365	3,747	4,149	4,520	4,939	5,373
45	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,156	2,440	2,732	3,094	3,463	3,865	4,282	4,663	5,102	5,526
46	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,207	2,500	2,801	3,174	3,559	3,978	4,413	4,807	5,258	5,720
47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,262	2,563	2,869	3,258	3,657	4,096	4,546	4,950	5,420	5,890
48	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,320	2,630	2,946	3,348	3,762	4,219	4,683	5,097	5,585	6,065
49	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,373	2,690	3,027	3,433	3,859	4,335	4,816	5,245	5,744	6,236
50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,426	2,753	3,107	3,516	3,960	4,453	4,949	5,388	5,907	6,409
51	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,485	2,821	3,189	3,599	4,059	4,568	5,082	5,536	6,060	6,579
52	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,540	2,884	3,268	3,685	4,150	4,686	5,215	5,679	6,225	6,752
53	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,593	2,947	3,351	3,769	4,259	4,804	5,348	5,822	6,388	6,925
54	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,658	3,010	3,434	3,853	4,357	4,922	5,481	5,965	6,554	7,093

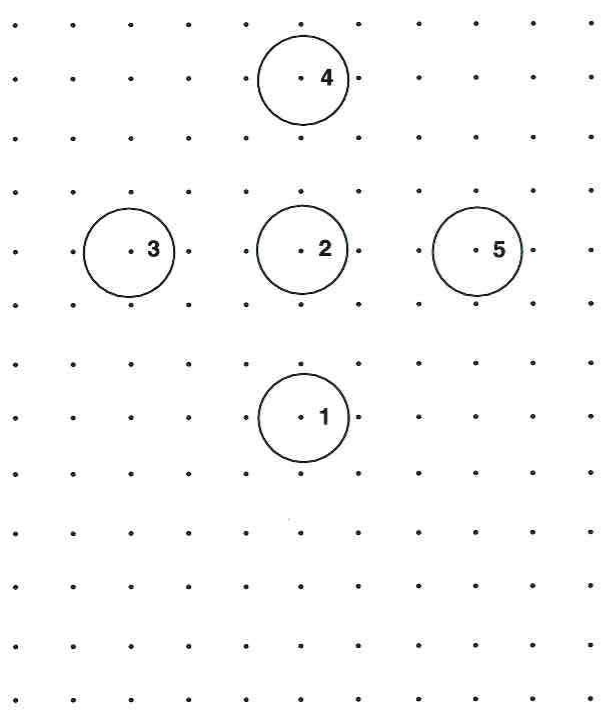
APPENDIX 14 -- SAMPLE PLOT FORMS

2000 WESTERN WASHINGTON INVENTORY PLOT RECORD

County _____( ) **Date** _____ **Recorder (s)** _____

Plot Number _____ **Estimator (s)** _____

PLOT LAYOUT



RP Data

species _____

diameter _____ in.

azimuth _____

slope dist. _____ ft.

to subplot # _____

RP Location and Description

_____

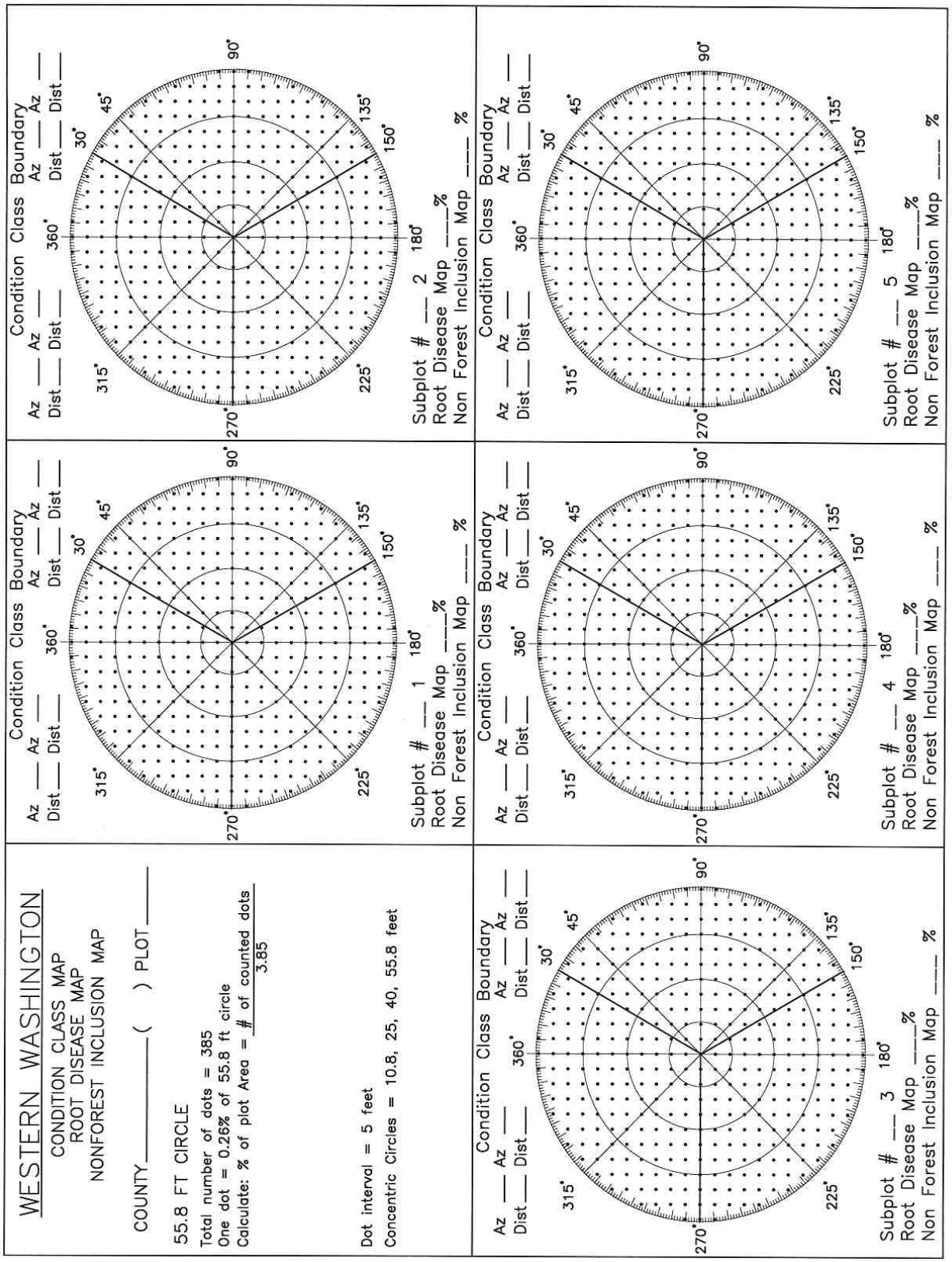
Present Condition -- Past Disturbance

_____

Items to be field checked: _____

Items to alert office about: _____

Are the downloaded Owner Group and Owner Class correct? (Y or N) ____ If NO, Explain: _____



??? INSERT ADDITIONAL UNNUMBERED PLOT FORMS HERE

APPENDIX 15 -- INDEX

APPENDIX 16 -- IMPORTANT PHONE NUMBERS

	Office	Home
PFSL front desk - AST	503 808-2000	fax 503 808-2020
Dale Baer - Data Collection Supervisor	503 808-2052	509 427-4822
Perry Colclasure - Data Manager	503 808-2054	503 335-3857
Chuck Veneklase - Programming & Husky guru	503 808-2045	503 281-7892
Sue Willits - Program Manager	503 808-2066	503 698-2601
Dale Weyermann - GIS	503 808-2042	503 232-0313
Bruce Hiserote - computer equipment	503 808-2056	
Sue Ferneau - IBM, network 808-2030 local pager	503 938-0036	pager 800 473-6519
Jimmy Ward - computer support 808-2039 local pager	503 229-9829	pager 800 844-3596
Marietta Hauser - AO / Accident Reporting	503 808-2032	503 223-1625
DeAnna Thrall - Per Diem	503 808-2029	
Cheryl Holt - Purchasing	503 808-2011	
Bob Rhoads – FIA WA	503 808-2022	503 281-7892
Walter Grabowiecki – P3 WA/OR	503 808-2034	503 789-8296
Sarah Butler	503 808-2083	503 231-5629
Adam Blackwood – FIA OR	503 808-2028	503 293-3803
Brett Anderson - FIA OR	503 808-2008	
Mike Hogan – FIA OR	503 808-2077	503 287-1990
Melissa Patterson – FIA WA	503 808-2087	503 771-5259
Cort Skolout – FIA WA	503 808-2035	503 936-0630
Voice mail: messages on your phone	800 327-4706	ext, #, password, #
to call someone in the office	get into mailbox (above) then:	0*, ext#
Lotus notes mail	entra6a.fs.fed.us/webmail.nsf	
R6/PNW		
Personnel - Barbara O'Day	503 808-2649	
Cheryl Zerkel	503 808-2621	
Pat Freeman	503 808-2653	
Accident Reporting	503 808-2646	
Publications - Diane Smith	503 808-2138	
FS Law Enforcement & Investigate 24hr/day, 365/yr	800 370-8732	
Special Agent in Charge R6 Tom Lyons	503 808-2681	
North Zone	503 808-2686	
South Zone	503 808-2687	
Fleet Manager, Mt.Hood NF - John Gilmore	503 668-1774	
GSA Vancouver, WA : Rick DeMorgan	206 699-1072	fax 206 696-7675
**Maintenance Center (All GSA repairs/service)	888 622-6344	
Haskell Coordinator - Brenda Smith	785 749-8493	
Oregon Department of Forestry		
Alan Kanaskie - Pathologist	503 945-7397	
Dave Overhulser - Entomologist	503 945-7396	
Washington DNR – Marc Titus/Sharon Mazzucco	360 902-1783/360 902-1664, cell 360 791-3244	
USGS (NAPP photos) EROS Data Center, Customer Service		605 597-6151
WAC Corp. (WAC photos) Eugene, OR		800 845-8088
BLM Districts		
Baker Resource Area	541 523-1256	
Burns District Office	541 573-4400	
Klamath Falls Resource Area	541 883-6916	
Lakeview District Office	541 947-2177	
Prinville District Office	541 416-6700	
Vale District Office	541 473-3144	

.

APPENDIX 17 -- VEHICLE & PHONE NUMBERS

FIA Field Vehicles 2000

Vehicle	YR	Plate #	Color	$/mo	$/mi	Phone #	Use 2000
Oregon annual inventory							
Cherokee 242-8145	98	A275972	FS Grn	$231	0.14	704-6587	OR-AL
Cherokee 242-7108	96	A276015	FS Grn	$231	0.14	704-8818	OR-AL
Cherokee 242-3623	94	A246555	FS Grn	$231	0.14	703-1592	OR-AL (Brett)
Bronco	93	G62-19057	dark blue	$257	0.15	704-9747	OR-AL (Adam)
Cherokee	9?	G61-33621	green	$276	0.14	704-0137	OR-AL (veg Mike)
WWA periodic inventory							
North crew (Cort)							
Cherokee	98	G61-00626	lt. blue	$276	0.14	704-9746	WWA
Cherokee	98	G61-37357	white	$276	0.14	708-8422	WWA
Explorer 5	20	G61- ?	?	$276	0.14	708-8416	WWA
South crew (Melissa)							
Cherokee	98	G61-00632	lt. blue	$276	0.14	708-8420	WWA
Cherokee	98	G61-00803	white	$276	0.14	704-6874	WWA
Cherokee	97	G61-03547	green	$276	0.14	704-1929	WWA
Misc.							
Bronco	96	G62- 24992	gray	$257	0.15	708-8418	WWA
Bob Rhoads		POV		x		704-9031	WWA (Bob R)
P3 crew							
Explorer 1	20	G61- ?	?	$276	0.14	704-1359	P3 (Walt, John)
Explorer 2	20	G61- ?	?	$276	0.14	701-4236	P3 (Joe, Linda)
Explorer 3	20	G61- ?	?	$276	0.14	701-4239	P3 (Scott, Lydia)
Pickup 2wd	94	G42-70590	dark blue	$193	0.15	704-9485	P3 (veg Colleen)
Explorer 4	20	G61- ?	?	$276	0.14	708-8421	P3 CA (Sam, Chris)
Misc.							
Cherokee	94	G61-28689	dark blue	$276	0.14	708-8419	Office truck
Pickup 2wd, ex cab	94	G43-57052	red	$227	0.16	n/a	n/a Susan Hummel
Dale Baer		handheld phone				704-1410	Dale B
?		handheld phone				704-1513	
?		handheld phone				704-1589	

NEED FOR 2000

Oregon Annual	5	3 green fleet + G62-19057+ 1 for botanist (Hogan)
OR/WA Phase 3	4	3 crews + 1 for botanist (C.Rash)
CA Phase 3	1	Explorer if possible
WWA Phase 2	8	15 people = 7 crew, + Bob
OFFICE truck	1	
	19	Total

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APPENDIX 18 -- BLANK PAGES FOR NOTES

BLANK PAGE FOR NOTES

BLANK PAGE FOR NOTES